DOCUMENT RESUME

ED 140 968	PS 009 352
TITLE	Feeding the Preschool Child: Documents Issued by PAG Ad Hoc Working Group Meetings (1969-1975).
INSTITUTION	United Nations Industrial Development Organization, Vienna (Austria).
PUB DATE	7 May 76
NOTE	174p.; Papers prepared by the United Nations Protein-Calorie Advisory Group
EDRS PRICE	MF-$0.83 HC-$8.69 Plus Postage.
DESCRIPTORS	Behavior; *Developing Nations; *Food; Food Standards; *Health; Health Services; Infant Mortality; *Infants; Learning; Legislation; Mental Development; *Nutrition; Pregnancy; Prenatal Influences; *Preschool Children; Social Influences
IDENTIFIERS	*Protein Calorie Advisory Group (PAG); *United Nations

ABSTRACT

This document contains six papers prepared between 1969 and 1975 by the Protein-Calorie Advisory Group (PAG) of the United Nations on topics related to the feeding of preschool children in underdeveloped countries. Among the topics covered: (1) nutrition in utero; (2) nutritional aspects of breastfeeding; (3) infant mortality rates as indicators of nutritional advances; (4) nutritional implications of milk intolerance; (5) standards and regulations for special foods for infants and young children; (6) legislation for protection of working women during pregnancy and lactation; (7) use of home-prepared legumes and green leafy vegetables; (8) nutrition activities of local health services; (9) emergency foods for infants and young children; and (10) the relationship of pre- and postnatal malnutrition in children to mental development, learning, and behavior. (JMB)

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PROTEIN-CALORIE ADVISORY GROUP (PAG) OF THE UNITED NATIONS SYSTEM

7 May 1976

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DOCUMENTS ON FEEDING THE PRESCHOOL CHILD
ISSUED BY
PAG AD HOC WORKING GROUP MEETINGS (1969 - 1975)

PS 009352

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Contents

Page

1. The 2nd meeting of the PAG ad hoc Working Group on Feeding the Preschool Child held 14-18 September 1970 in Geneva, Switzerland 1
2. The 3rd meeting of the PAG ad hoc Working Group on Feeding the Preschool Child held 26-28 October 1971 in Washington, D.C., U.S.A. 67
3. The meeting of the PAG ad hoc Working Group on Milk Intolerance - Nutritional Implications held 29-30 October 1971 in Washington, D.C., U.S.A. 95
4. The 4th meeting of the PAG ad hoc Working Group on Feeding the Preschool Child held 11-13 December 1972 in Geneva, Switzerland 128
5. The 5th meeting of the PAG ad hoc Working Group on Feeding the Preschool Child held 10-12 February 1975 in Geneva, Switzerland 161
6. PAG Statement No. 17 - Low Lactase Activity and Milk Intake 97
7. PAG Statement No. 18 - Relationship of pre- and postnatal malnutrition in children to mental development, learning and behavior 164
8. PAG Guideline No. 8 - Protein-rich mixtures for use as weaning foods 166

Summary

Geneva, Switzerland

SECOND MEETING OF THE PAG AD HOC WORKING GROUP ON FEEDING THE PRESCHOOL CHILD

The PAG *ad hoc* Working Group on Feeding the Preschool Child held its second Meeting in Geneva, 14 - 18 September 1970.

Members of the Group present were: Professor Bo Vahlquist (Chairman), Sweden; Dr. J. K. Harfouche, Lebanon; Dr. F. Monkeberg, Chile; and Dr. A. H. Niehoff, U. S. A. Dr. A. Omololu, Nigeria, was a special participant. Advisers were Dr. A. Dahlqvist, Sweden; Miss M. E. Cameron, England; Miss Marina Flores, Guatemala; and Dr. Yngve N. Hofvander, Sweden. Representatives of WHO were Dr. J. M. Bengoa, Dr. E. M. DeMaeyer, Mr. G. Plouidy, Dr. A. Raba, and Dr. F. Rosa. Other groups represented were: FAO, by Dr. P. L. H. Davey; WHO/PAHO, by Dr. D. S. Jelliffe, Jamaica; UNICEF, by Dr. L. J. Teply; and the International Children's Centre, by Professor Satge, France. Mrs. P. Jelliffe was an observer. Dr. O. Ballarin, Brazil, attended for the PAG, and Dr. P. S. Venkatachalam for the PAG Secretariat.

The extensive literature on nutrition *in utero* was reviewed to evaluate the effects of maternal nutrition status during pregnancy on the mother and the foetus, immediately as well as in the long range. It was noted that many observations made remained difficult to interpret because of the several interrelated factors influencing the outcome of pregnancy. The currently important question of the interrelationship between family planning and nutrition was considered, with special reference to the effect of repeated pregnancy on the health of family members and on the relationship between nutrition and family planning programmes.

The current knowledge with regard to nutrient requirements of infants and children was reviewed. The importance of fat in infant nutrition, disaccharides in infant and child feeding and current information on trace elements requirements were some of the other aspects touched upon.

The consequences of shortening the duration of lactation in less technically developed areas of the world were discussed and the factors responsible for this development and suggestions for preventive action against failure to breast feed were considered. The Group felt a need to obtain more information on current practices of infant feeding and trends, if any, in different parts of the world. Similarly, the need for collecting data on food consumption of preschool children was stressed. The Group recommended the preparation of a manual on methodology of such surveys and training of staff to enable the development of uniform procedures.

A draft manual on feeding infants and young children, with emphasis on home-prepared weaning foods, by Dr. Hofvander and Miss Cameron, was reviewed and suggestions for a revision by the authors were worked out in detail. The revised manual is expected to be ready in early 1971.

The social, cultural and economic factors which influence child feeding patterns, the principles governing the organization and development of different communications channels and the extent of their influence on the mother, family and the community were discussed. The current experience with the operation of a few preschool protection programmes was described.

With regard to disaccharidase deficiency, the Group felt that further studies are required to assess the public health significance of the problem. The importance of combined action against malnutrition and infectious diseases was stressed once again. The other subjects discussed were preschool child feeding in times of disaster and experience with the use of special mixtures for treatment of PCM.

A combined technical report covering the two meetings of this Working Group will be issued by the PAG in 1971.

FAO/WHO/UNICEF
Protein Advisory Group

October 1971

Document 1.14/5

FEEDING THE PRESCHOOL CHILD

REPORT OF A PAG *AD HOC* WORKING GROUP

PREFACE

At the 16th Meeting in Geneva, September 1969, the FAO/WHO/UNICEF Protein Advisory Group recommended the establishment of an ad hoc Working Group on Feeding the Preschool Child. The ad hoc Group has since met in Geneva on two occasions, December 1969 and September 1970. The list of participants is given in an Appendix. The report which follows is based on the deliberations at the two meetings and was approved for publication by the PAG at its 18th Meeting in Rome, 9-12 February 1971.

On the initiative of the ad hoc Working Group, a Manual on Feeding Infants and Young Children, with special attention to home-prepared weaning foods, has been prepared by M. Cameron and Y. Hofvander. The PAG, at its 18th Meeting in Rome, 9-12 February 1971, also approved the publication of the Manual. Following a proposal from the ad hoc Working Group, the PAG has recommended the holding of a study group meeting on "Milk intolerance - its prevalence and public health implications" during 1971. It is also planned to hold at least one more meeting in 1971 of the ad hoc Working Group on Feeding the Preschool Child to consider several new topics.

CONTENTS

PAGE

1. NUTRITION IN UTERO 5
2. NUTRIENT REQUIREMENTS OF INFANTS AND YOUNG CHILDREN 10
3. FAMILY PLANNING, FERTILITY AND NUTRITION 17
4. SOCIOCULTURAL DYNAMICS OF BREAST FEEDING 20
5. COMPLETE FORMULATIONS FOR INFANTS UNDER SIX MONTHS DEPRIVED OF BREAST MILK 27
6. HOME - PREPARED WEANING FOODS 32
7. INTRODUCTION OF PROCESSED PROTEIN - RICH FOODS 33
8. STANDARDS AND REGULATIONS FOR INFANT AND WEANING FOODS 34
9. CHANNELS FOR INFLUENCING PRESCHOOL CHILD FEEDING 34
10. METHODOLOGY OF PRESCHOOL CHILD FOOD CONSUMPTION SURVEYS 42
11. NUTRITION SURVEYS 44
12. MILK INTOLERANCE AND NUTRITIONAL IMPLICATIONS 44
13. NUTRITION AND INFECTION 45
14. SPECIAL MIXTURES FOR TREATMENT OF PCM AND FOR USE IN SUPPLEMENTARY FEEDING 53
15. PRESCHOOL CHILD FEEDING IN TIMES OF DISASTER 54
16. NUTRITION IN MEDICAL TRAINING 57

FEEDING THE PRESCHOOL CHILD

REPORT OF A PAG AD HOC WORKING GROUP

1. NUTRITION IN UTERO

1.1 Introduction

The necessity of providing an adequate diet for the pregnant woman has been reviewed extensively in the medical literature (1, 2). Calculated from the WHO/FAO recommendations for dietary allowances, the additional amounts of nutrients for a woman with a gestation period of 280 days and lactating for 180 days (total 460 days) is as follows:

Calories	219,200
Protein, NPU 70, g	6,400
Calcium, g	176
Vitamin D, I.U.	168,000
Vitamin A, mcg	90,000
Ascorbic acid, mg	9,200
Folate, mg	74
Niacin equivalent, mg	1,540
Riboflavin, mg	90
Thiamine, mg	100

The figures may be used as desirable targets for those responsible for national or regional food policies.

Nevertheless, the subject of maternal-foetal nutrition remains difficult to interpret because of the many interrelated factors in the outcome of pregnancy, such as physical work during pregnancy and other physiological and pathological stresses. Besides, sufficient information is not available on the effect of maternal diet as related to general health of the woman during pregnancy and between pregnancies; foetal growth *in utero*; birth weight of neonate; and quality and quantity of breast milk produced. The available information on the subject has been recently reviewed (3).

1.2 Clinical evidence

Women from lower socioeconomic strata appear to be more vulnerable during pregnancy than women living in more favourable environments. Among the former are found:

a) A higher rate of low-birth-weight babies, which is true both in comparisons between countries and in comparisons between populations of differing levels within countries (4).

b) A higher incidence of toxaemia of pregnancy, especially among malnourished women and young primiparae (5).

c) A high prevalence of anaemia (defined as less than 11g haemoglobin per 100 ml), though the interpretation of haematological data is complicated by the physiological haemodilution of pregnancy. To prevent iron deficiency and anaemia, the WHO Scientific Group (6) recommended that 60mg of iron should be given daily throughout pregnancy and lactation; in regions where folate deficiency is prevalent 100mcg of folate should also be given.

1.3 Anthropometric evidence

1.3.1 Maternal height. Good correlations have been found between socioeconomic and nutritional status and the height of individuals within a community. Perinatal mortality rates are lower in tall women than in short women and tall women give birth to larger neonates (7).

1.3.2 Weight gain during pregnancy. Physiological adjustments occur early in pregnancy and reserve body fat is laid down, which, it is believed, will subsidize lactation if the maternal diet is low in calories (8).

In most developed countries the expected average weight gain is 10-12 kg. Charting weight gain has been found a useful device for monitoring progress of the pregnancy. In developing countries, however, weight gains may be only of the order of 2-7 kg and in some instances no weight gain has been reported (9, 10). Infants born of these mothers are likely to have a lower birth weight.

1.3.3 Maternal weight for height. The ratio of maternal weight to maternal height is also of great importance. Obstetricians have stressed the vulnerability of the underweight as well as the markedly overweight woman to pregnancy complications and a poor pregnancy outcome (11).

1.4 Effect of repeated pregnancies on maternal nutritional status and that of neonate

The desirable interval between pregnancies is at least two years, since the cumulative effect of repeated pregnancies may lead to a general "maternal depletion syndrome". Information on the relationship between maternal nutrition and foetal stores is scanty.

A statistically significant relationship has been shown between the number of pregnancies and maternal and infant death rates (12). In countries where a high infant mortality rate exists, repeated pregnancies are likely to occur, resulting in an increased maternal morbidity and mortality rate. Also, in families with closely-spaced pregnancies, surviving children will more likely develop protein-calorie malnutrition because of an inadequate diet and other stress factors than in those with well-spaced pregnancies.

Conversely, birth spacing measures can help not only in the maintenance of good nutrition in the mother, foetus and neonate but also help to maintain lactation. However, oral contraceptives containing high doses of oestrogens taken soon after delivery may unfavourably affect the duration of lactation. Though successful lactation seems not to possess a reliable contraceptive effect, further studies are required to understand the complex relationship between successful breast feeding and contraception.

1.5 Effect of diet in pregnancy on lactation

There is some evidence that changes in the composition of breast milk occur when the diet of the nursing mother is markedly inadequate. However, there are not many reported studies which indicate the effect of diet in pregnancy on the composition and output of milk.

Available data suggest that during early lactation, water-soluble vitamins and vitamin A content of breast milk may be influenced by the intake of these nutrients during pregnancy. Severe dietary stress during pregnancy may affect the production of breast milk and reduce the period of lactation.

1.6 Effect of maternal diet on neonatal weight

To date there have been very few adequately controlled studies in less developed countries and the ones undertaken in more developed countries have shown equivocal results, apparently because large populations with marked malnutrition are not found in these countries.

Follow-up studies on infants soon after birth and studies on twins provide convincing information that the small-for-date infants, those with low weight for gestational age at birth, may frequently suffer from long-term developmental sequelae in the form of backwardness in physical growth and intellectual performance (13, 14, 15). The sequelae are due, at least in some, to developmental defects acquired during intrauterine life, which may be of a genetic or an infective origin. However, the more important problem is what are the long-term developmental consequences of malnutrition during intrauterine life caused by factors extrinsic to the foetus. Observations gathered by the WHO in its study of low birth weight, which involved thirty-seven countries, indicate a widespread occurrence of small-for-date infants. There is a great need for the collection of more data, such as anthropometry of both mothers and neonates including birth weights, using carefully checked instruments and wherever possible, extending the observations by following up the growth and development of the infants.

Maternal malnutrition is only one of the several factors which has been associated with a low birth weight. However, a diversity of other factors are known to affect the weight at birth. For example, placentae infected with malarial parasite have been shown to be associated with low birth weight of infants (16). While such findings emphasize the importance of several factors which influence birth weight, these observations leave several questions unanswered. What is the significance of low birth weight? To what extent can birth weight be improved and neonatal development helped by specific nutritional measures during pregnancy? To get practical answers to these questions, systematic studies must be carried out in different regions where food supplements are distributed to pregnant women to determine the effect on pregnancy outcome, birth weight, and neonatal growth and development. The choice of the supplement requires careful consideration and will depend on the prevalent deficiency, whether calories or proteins or both. What is the relative importance of calories and proteins? And when and for how long does diet need to be supplemented to influence pregnancy outcome, lactation and postnatal performance optimally? Could this possibly lead to dystocia? What is the rational and practical approach to some less severe, culturally-defined dietary limitations in pregnancy? Is it possible or desirable to delineate an optimal range of birth weights for particular communities in relation to maternal stature and genetic potential and survival of the child? In Guatemala, village children with birth weights below 2100g have been shown to have a greater neonatal and postnatal mortality than children born with higher birth weights (17).

1.7 Research areas

The above discussion points out the need for more careful and well-planned studies to clarify many issues. The primary need is to get more information on food consumption throughout pregnancy and lactation. Well-controlled trials in different less developed areas, where various types of maternal malnutrition are prevalent, are necessary to evaluate the benefits of supplementation. Studies using newer biochemical techniques may help to obtain data on foetal development and foetal stores and role of the placenta in the nutritional relationship between mother and foetus. Further work is also required to understand the effect of maternal diet during pregnancy and lactation on milk composition.

1.8 Advice on the maternal diet

Realistic advice must be given the mother regarding a diet based on locally available foods which is nutritionally well balanced, including concern for calories, proteins, minerals and vitamins, and which is culturally acceptable and within economic reach.

The nutritional concern in pregnancy should also be integrated with still broader concerns such as education for family planning, for prevention and management of infections, and for avoiding heavy physical labour in the latter part of pregnancy. It can be expected that these approaches will greatly contribute to the improvement of preschool nutrition, not only by improving foetal nutrition and the outcome of pregnancy but also by ensuring maternal resources for lactation. A live and lively mother is needed for the care of her infant.

2. NUTRIENT REQUIREMENTS OF INFANTS AND YOUNG CHILDREN

2.1 Introduction

Growth during infancy and early childhood involves a great increase in body size, a rapid gain in weight, alterations in body composition and adjustments in physiological functions. During early infancy the above changes take place at a high rate, decreasing rapidly during the first year and more gradually afterwards. The nutritional requirements during early life, expressed on the basis of unit body weight, are therefore comparatively higher than those of adults.

Healthy full-term infants receiving only breast milk from well-nourished mothers are reported to grow satisfactorily during the first four to six months after birth. The nutrient content of the daily output of milk (on a gross average about 850ml when the infant is 4-6 months old) may, therefore, be accepted as an estimate of the nutritional requirement of infants of four to six months of age.

2.2 Energy requirements

Apart from the needs for growth and maintenance, energy is required by the infant for chemical maturation and for body activity. The variation in calorie requirements among infants is largely due to differences in their body activity. In a study by Rose and Mayer (18), during a 4-6 month period, it was found that the calorie intake of the infants was more closely related to the degree of activity (as measured by a special "actometer") than to their size and not at all related to growth. The lowest intake in this series of 29 infants was 84 cal/kg and the highest 134 cal/kg per day.

The Joint FAO/WHO Expert Committee (1971) recommended 120 calories per kilogram body weight for infants up to 3 months; 115 between 3 and 6 months; 110 between 6 and 9 months; and 105 between 9 and 12 months (19). For children between one to four years inclusive, the Committee recommended 1350 calories per day.

2.3 Protein requirements

Protein is required for maintenance of tissue, laying down new tissue and for maturation. Reviewing the results of various studies on the amount of protein ingested by infants from breast milk or cow's milk which supports satisfactory growth, the Joint FAO/WHO Expert Committee (19) concluded that the following figures cover the protein requirements of infants and would provide for the full range of individual variability in terms of either breast milk or cow's milk protein:

up to 3 months - 2.25g per kg
3-6 months - 1.82g per kg
6-9 months - 1.62g per kg
9-12 months - 1.44g per kg

The protein requirements of infants are expected to be similar if other animal proteins are used, after suitable processing for use by infants. Yanez et al.(20) have shown that the growth of two-month-old infants was normal with an intake of 2.5g of adequately processed fish protein per kg body weight. Further studies, testing other varieties of processed animal proteins suitable for infant feeding, are necessary. In the case of vegetable proteins, which are known to be deficient in one or more essential amino acids, the protein requirement must be based on essential amino acid composition and the ability to meet the essential amino acid requirement rather than on the protein content of the food.

There are a few publications on the amino acid requirements of infants. In nearly all of these studies, the amino acid requirement has been determined under special conditions. Based on the results of these studies, the Joint FAO/WHO Expert Committee (1971) (19) has developed a requirement pattern as follows:

TABLE I

Amino Acid Requirement to Support Growth in Infants Under 6 Months of Age (19)

Amino acid	Requirement mg/kg/day	Quantity provided by human milk at a protein intake of 1.6g/kg/day (mg/kg/day)
Histidine	28	42
Isoleucine	70	74
Leucine	150	149
Lysine	103	103
Methionine	29	34
Cystine	33	34
Phenylalanine	61	67
Tyrosine	68	70
Threonine	87	69
Tryptophan	17	27
Valine	93	88

It will be seen that the requirements arrived at in the experiments were generally similar to those calculated from the composition of breast milk except for threonine, tryptophan and histidine. Since breast milk is adequate for growth of young infants, possibly the requirement of threonine arrived at from experiments may be somewhat high. Similarly, the tryptophan and histidine values might have been underestimated in the experimental values. The amounts present in 1.6 g breast milk protein are accepted by the Joint Committee as the best estimate of amino acids needed per kg infant body weight.

Even if the amino acid pattern is satisfactory, vegetable protein foods intended for infants and young children must be properly processed to ensure adequate digestibility and to minimize their bulky nature, which might prevent infants from consuming sufficient amounts to meet their protein needs. Although the value of certain processed products based on soybeans in the feeding of infants has been established, further studies are needed on the metabolic aspects of feeding various proteins of vegetable origin to infants under six months of age. Small quantities of animal protein concentrates could be added to such vegetable protein foods to improve protein quality.

For children between one and two years, the FAO/WHO Expert Committee (1971) has recommended 1.27 g protein per kg per day from egg or milk. For children between 2 and 3 years, the recommended intake is 1.19g per kg/day from the same sources. Proportionately greater quantities are needed if the protein used is one which is incompletely utilized. The intake capacity of children in this age group may not allow the provision of adequate protein of NPU below 60.

2.4 Fat requirements

There is evidence that humans require small quantities of polyunsaturated fatty acids. Deficiency of essential fatty acids has been produced experimentally in human infants when linoleic acid accounted for less than 0.1% of total calorie intake (21). When essential fatty acids are provided at about 1% of calorie intake in normal infants, skin manifestations of essential fatty acids deficiency do not appear and rates of growth are as rapid as those of infants receiving higher intakes of linoleic acid. However, there is no information on the requirements of fat during infancy and childhood. Exclusively breast-fed babies receive nearly 50% of the calories from fat. Also, the linoleic acid content of human milk is nearly five times higher than that of cow's milk. Unsaturated fats and those containing medium- and short-chain fatty acids are better digested and absorbed by infants and children than those with saturated long-chain fatty acids. The absorption of fat-soluble vitamins, especially provitamin A, is facilitated by dietary fat.

The calorie density of fat appears to be important during early life when energy requirements per unit body weight are high. Fat also improves the palatability of the food. Based on these considerations, it is recommended that some quantity of fat be included in the diet of infants and children, preferably fats with short- and medium-chain fatty acids and containing the essential fatty acids. A level of fat contributing 50% of the total daily calorie intake may be aimed at for infants and not less than 25% of the total calorie intake for children between one and three years.

2.5 Carbohydrate requirements

There is no information regarding the carbohydrate requirements of infants and children. An infant fed exclusively on breast milk receives nearly 40% of the calories from the disaccharide lactose. This may serve as a rough guide, although the intake of carbohydrate calories has to be raised proportionately if the fat intake is reduced. Depending on the fat calories supplied, 40 to 60% of the calorie requirement may be given in the form of a suitable mono- or disaccharide during early infancy. Infants fed milk receive lactose as the main carbohydrate source. Though lactose seems to stimulate the absorption of calcium in the small intestine, it does not seem to possess any other advantage and may therefore be replaced by glucose or other mono- or disaccharides. For older infants and young children, the amount of carbohydrate calories may be around 60% of the total and may be provided largely in the form of starch.

2.6 Mineral requirements

With the exception of iron, the breast-fed infant is adequately provided with all minerals and it may be assumed that the quantities received through milk are well above the requirements, at least during the first part of infancy. Additional iron has to be provided after four to six months for all children. The WHO/FAO Expert Group (22) recommended the following iron intakes for infants and children.

	Animal food below 10% of calories	Animal food between 10-25% of calories	Animal food over 25% of calories
5-12 months	10mg	7mg	5mg
Children	10mg	7mg	5mg

For infants 0-4 months, breast feeding is assumed to be adequate. Healthy infants fed solely on breast milk receive approximately 300 mg of calcium per day. However, there is no information regarding calcium needs of growing children. The WHO/FAO Expert Group (23) suggested an allowance of 500-600 mg per day for infants not fed on breast milk. The same figure may be accepted for children between one and three years.

2.7 Vitamin requirements

The WHO/FAO Expert Groups (22, 24) have reviewed the available information on vitamin A, thiamine, riboflavin, niacin, ascorbic acid, folate, vitamin B_{12} and vitamin D, and have made recommendations regarding their requirements.

2.7.1 Vitamin A. For infants up to six months, the Expert Group concluded that breast feeding by a well-nourished mother is the best way to satisfy nutritional requirements. On the basis of the composition of human milk it may be suggested that during the first half of infancy, the intake should be 425 mcg of retinol per day. The Group recommended an intake of 300 mcg of retinol per day for infants between six months and twelve months and 250 mcg between one and three years.

2.7.2 Thiamine, riboflavin and niacin. For infants up to six months, the Expert Group accepted that breast milk from well-nourished mothers will supply the nutritional needs adequately. This would mean that the intake of thiamine, riboflavin and niacin should be 0.20 mg, 0.37 mg and 1.5 niacin equivalents (1 niacin equivalent = 1 mg of niacin or 60 mg tryptophan) respectively for infants up to six months of age. For older infants and children under three years, the Expert Group recommended 0.40 mg of thiamine, 0.55 mg riboflavin and 6.6 niacin equivalents for 1000 calories per day.

2.7.3 Vitamin C. The vitamin C needs of most infants are met by full breast feeding at least during the first six months of life. This supplies an estimated 20 mg of ascorbic acid daily when the diet of the mother is adequate. The WHO/FAO Expert Group recommended that all infants and children have a daily intake of 20 mg of ascorbic acid.

2.7.4 Vitamin B_{12} and folate. The WHO/FAO Expert Group recommended 0.3 mcg and 40 mcg of B_{12} and folate respectively for infants and 0.9 mcg and 100 mcg of B_{12} and folate respectively for children between one and three years.

2.7.5 Vitamin D. Provitamin D is always present in the skin. When ultraviolet light rays of a particular wave length strike the skin, they convert the provitamin into vitamin D. Sunlight is able to convert the provitamin into the vitamin, but appears to be less efficient than artificial sources of UV radiation. Also, the UV rays of the sun do not penetrate deeply, especially in dark skin, due to absorption of these rays by the melanin pigment. However, if the whole or part of the body of the infant or the child is exposed to strong sunlight for short periods every day, there does not appear to be any special need for a vitamin D supplement. The vitamin D obtained through biosynthesis in the skin and that from breast milk would suffice. There is some evidence, however, that under special dietary and environmental circumstances, a vitamin D supplement may be necessary to give maximum calcium absorption (25). A daily intake of 10 mg (400 IU) of vitamin D has been recommended for infants and a similar amount for children (22).

2.8 Requirements for trace elements

A trace element may be defined as an element that occurs in the body in very small amounts. These elements participate in body metabolism by acting in combination with proteins or as prosthetic groups of enzymes.

If a concentration up to 0.005% (50 ppm) in the human body may be considered "trace", copper, zinc, cobalt and iodine may be included in the list of trace elements. There is also evidence to justify adding manganese, molybdenum, fluorine, selenium, vanadium and strontium to this list.

The estimation of minimum daily requirements for trace elements is difficult. Since their mechanism of action is attained as part of an enzyme or by linkage to a protein, it is difficult to know to what extent they are indispensable. In view of the known effects of iodine deficiency, it is suggested that infants and children receive at least 4 mcg of iodine per kg (26).

2.9 Requirements for water

The infant is readily susceptible to lack of water or insufficient intake of water. Similarly, excess intake of water by the infant has serious consequences. The problem of water requirement is particularly important in the case of breast-fed infants because of the difficulty of assessing the volume of milk intake. The subject requires detailed examination before suitable recommendations can be made.

3. FAMILY PLANNING, FERTILITY AND NUTRITION

3.1 Introduction

Section one touched on only one small aspect of the interrelationship between family planning and nutrition: the effect of fertility on nutrition of mother and foetus. The much broader relationship between the two can be categorized under three headings. First, the immediate effect of fertility on the nutrition of members of the family; second, the community effect of fertility; and third, the programme relationships between those concerning nutrition and those pertaining to family planning.

3.2 The effect of fertility on the nutrition of members of the family

The effect of fertility on the nutritional status of the previously born child is known to be of great importance. In most references on kwashiorkor the impact of intervening pregnancy and prematurely curtailed breast feeding is mentioned. Gordon, in his analysis of pregnancy interval and mortality based on longitudinal studies in the Punjab, suggested that probably the most important impact was on the second-year mortality rate of the preceding child, although the data are not well developed in this area (27). Another important aspect of pregnancy spacing and family size limitation is the overall economic effect of limiting the number of children so that they can be adequately reared and nourished with the family resources.

3.3 The effect of fertility on the nutrition of members of the community

High population growth rates undoubtedly act as a brake on economic and social development. Among other things, it becomes necessary to achieve an equally high increase in food production just to maintain the nutritional status quo. An even higher rate of increase in food production is required if the nutritional status is to be improved. In addition, population pressure within a community may be one of the factors causing changes in staple food production to increase total available calories. Such a switch may easily result in a detrimental change nutritionally, e. g. , a change from maize to cassava.

It is usually found that a gradual increase in purchasing power results in some nutritional improvement within the family, e. g. , a higher consumption of animal proteins is seen in many countries. This improvement in purchasing power, however, has to be measured on a per capita basis. It follows that high fertility within a family can easily cause a lowering of per capita purchasing power, with a consequent decrease in the nutritional value of quality protein. Hence, high fertility rates can result in a deterioration of nutritional status, both in the subsistence and the cash sectors of the economy. It is a universally observed fact in both industrialized and developing countries that for any given socio-economic level the nutritional value of the food consumed by a family decreases as the number of children in the family increases.

3.4 Programme relationships

There are many reasons why family planning activities should be coordinated with nutrition services and other measures for maternal and child health in developing countries. These have been extensively reviewed in several publications. One of the most important reasons is the shortage of manpower, particularly when one is trying to cover the peripheral rural population. In these areas one peripheral worker must cover the most urgent priority and can do it most efficiently by providing this in a continuum of family care. It is also apparent in these areas that there are many limitations to providing family planning only as an aspect of pregnancy management. Although mothers may be receptive to contraceptive advice during their care, immediately after delivery, many mothers will depend initially on the period of post partum amenorrhoea and in some cultures on post partum separation and will not be immediately receptive to other contraceptive measures. In these cases, contraception can best be offered later on as an aspect of continuing family care. The IUD introduced immediately post partum may also coincide largely with this period of post partum infertility unless follow-up is provided to ensure that the IUD stays in place or is reinserted, if necessary. Pills are not advisable in breast-feeding mothers. In all these cases, contraception can best be offered later on as an aspect of continuing family care. Both the IUD and the pill are likely to require continuous reinforcing inputs in order to be successful; the mother must be reassured when she starts the pill and experiences initial side effects. The same thing is true of the loop. These services can best be provided at the time that family care is being given and one of the main reasons for providing continuous family care is for both improvement of nutrition and overcoming problems interrelated with the nutrition of the children. The impact on the nutrition of the child and the assurance of its survival would thus appear to be the best rationale for introducing the subject of family planning to the mother. By making nutrition programmes and family planning programmes mutually supportive we could look forward to the strengthening of both.

4. SOCIOCULTURAL DYNAMICS OF BREAST FEEDING

4.1 The change

Traditional feeding of young infants* in all parts of the world has always depended on the availability of a sufficient supply of human milk, especially for the first six months of life. In the present century, there has been a progressive decline in breast feeding in the industrialized countries of Europe and North America, made possible by modern developments in dairying and food technology. These have resulted in widely available supplies of processed milk suitable for feeding young children and within the financial range of parents in these communities. Unfortunately, this decline in breast feeding and shortening of the duration of lactation has spread rapidly in the last two decades to less technically developed areas of the world with increasingly serious consequences. The dimensions of this change vary considerably, but is seen in an extreme form in Chile where breast feeding at one year of age has fallen in the past twenty years from 95% to 6%, and where only 20% of babies are still being breast fed at two months of age.

4.2 Benefits

There is increasing evidence that there are numerous biochemical, immunological and "anti-infective" differences between human milk and cow's milk and that for infants under unfavourable circumstances, breast milk has special value for the promotion of growth and development.

Breast feeding ensures an economic supply of hygienically clean food direct to the baby, provided the mother, during both pregnancy and lactation, receives an adequate balanced diet even if made up of low-cost locally-available foods. Also, breast milk is the original natural convenience food for infants, needing neither culinary preparation nor feeding utensils and available immediately.

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* Infants below 6 months of age are referred to as young infants.

The act of breast feeding is much more than the supply of nutrients; it is rather a biological communication between mother and baby, of benefit to the emotional development of both mother and child, and is relevant to adult personality development and adjustment to the community later in life.

Successful breast feeding may also decrease the likelihood of puerperal breast infection, abcess and fissured nipples in the mother. The incidence of mammary cancer appears to be lower in communities with rapid cycles of pregnancy and lactation.

4.3 Alternatives

While the advantages of human milk are universal - as would be expected of a secretion adapted to a particular species over millenia - it is well recognized that successful infant feeding can be achieved with various cow's milk formulas, as well as suitable formulas using specially processed vegetable proteins or vegetable proteins combined with small quantities of animal milk. However, this presupposes that adequate quantities can be afforded, purchased and fed under good hygienic conditions, as is generally the case in industrialized countries. It may be noted that in the long range such feeding may exert an influence on certain aspects of child growth and development.

In less technically developed areas of the world, much more immediate and serious basic difficulties attend attempts to artificially feed young infants on a cow's milk formula. These include a lack of sufficient money to buy adequate quantities, poor home hygiene (including water supply, fuel, feeding utensils, storage, etc.), and inadequate nutritional knowledge of the mother. Under these circumstances, usual for the majority in less developed countries, artificial feeds mean the use of too diluted, highly contaminated solutions of cow's milk, resulting at best in undernutrition; at worst, in marasmus and diarrhoeal disease.

As a result of the present trend away from breast feeding to frequently ineffective bottle-feeding, a predictable change in the pattern of malnutrition in young children has come about in certain urban areas, with malnutrition occurring at an earlier age, often in the first months of life, and with marasmus the main clinical form rather than kwashiorkor. The consequences of this desperate situation are grave.

It is well recognized that marasmus requires prolonged, costly treatment to obtain a cure, and in addition malnutrition at this early age increases the likelihood of permanent brain damage.

Widespread lactation failure also has unrealized consequences as regards both national economics and food production (28), since alternative sources of protein food suitable for babies have to be imported (with expenditure of foreign currency) and/or produced locally.

4.4 Causes of failure to breast feed

Failure to breast feed appears to be associated with a change to an urban life-style. This is most marked in actual urban surroundings but with the increased speed of communications of both people and ideas, especially via the transistor radio, it is extending also into periurban areas and in some countries, such as Chile, even involves rural regions.

The main factors in the urban life-style responsible for the decline in breast feeding may be considered under three overlapping headings; sociocultural change, effect of health services and the influence of commercial persuasion.

4.4.1 Sociocultural change. An urban life-style is characterized by a move towards a money economy and foods that are purchased, towards a small family rather than an extended unit, and towards a different role for women, who may be expected to work away from the home for wages and who, in any case, become less definitely and predominantly concerned with child rearing. There is also less opportunity for young women to learn from older women. There is a tendency to adopt certain practices, such as bottle feeding, which appear to symbolize the new life of the townsman, as exemplified by the educated, well-to-do elite.

In urban circumstances, the Western attitude to the breasts as cosmetic sex symbols rather than for nourishing young babies dominates the scene, with anxiety as to breast feeding being likely to lead to "losing one's figure", and custom making breast feeding in public taboo and even less acceptable at work.

4.4.2 Effect of health services. A major responsibility for the apathetic or misguided attitude to the current dangerous decline in breast feeding by mothers unable to provide a suitable substitute rests with the health services, including the general medical profession, and particularly paediatricians and obstetricians, nurses and midwives. Their complete lack of awareness is probably related to the fact that such infant feeding as is taught is concerned with problems of the elite, for whom Western-style bottle feeding with cow's milk formula is practical, and newer knowledge of the psychophysiology of breast feeding and the composition of human milk is rarely appreciated.

Conditions in obstetrical hospitals, children's wards and health centres are geared to artificial feeding. Newborn babies are routinely given unnecessary supplementary foods and switched to bottle feeding at the slightest "indication", or even automatically with no indication at all.

Paediatric wards may exclude mothers, even of breast-fed babies, and the indiscriminate use of bottle feeds in the ward promotes this practice.

Health services are often the channel through which food donations, of one sort or another, flow. In some cases, the food supplements issued, especially milk powders, have had the side effect of acting as "breast milk displacers", given with the tacit endorsement of the health services.

4.4.3 Commercial persuasion. During the last two decades the increased availability and consumption of expensive proprietary branded infant foods within developing countries, stimulated by commercial firms and in many countries also by the nature and scale of advertising campaigns which they have implemented, have seriously aggravated the trend towards breast-milk displacement. The passive attitude of many governments towards regulating the flow and use of such foods according to their nutritional value and potential benefit to consumers is also deplored.

Particular devices used by commercial companies to induce support from health services must be especially censured, e.g. the employment by some firms of "milk nurses" to make home visits and attend clinics to promote sales of specific products, the issue of free samples, posters, calendars, etc., as an incentive to favour particular brands or companies. Insufficient discrimination has been shown by companies in the content of their advertising communications, and the extensive use of mass media as a channel for such communications may have multiplied any detrimental effect of commercial advertising efforts on nutrition of the pre-school child.

The extensive introduction and indiscriminate promotion of expensive processed milk-based infant foods in some situations may constitute a grave threat to the nutritional status of the infants for whom they are intended. The sophisticated luxury and fashionable appeal of such products to the mother may lead to the undesirable effect of displacing the child from the breast, in circumstances where the mother may have no access to affordable alternative foods which can be given safely and without risk of alimentary infection and diarrhoeal disease.

4.5 Preventive action against failure to breast feed

The situation is likely to become increasingly grave with the flood of the "disurbanized"; that is, those urbanized without the essential employment and income, social services, environmental hygiene, etc., to make an urban life-style of infant feeding possible for years to come. If nothing is done, marasmus and diarrhoea will become increasingly widespread. The problem is how to devise a programme which, if not capable of reversing the trend, may at least prevent its spread to unaffected areas and decelerate the rate of change, hopefully permitting the parallel development of industrialization, urban employment and economic improvement. Key groups in this preventive programme include health staff, especially paediatricians, obstetricians and teachers in training schools; health administrators; peer groups; and those responsible for mass media, especially commercial infant food firms.

4.5.1 Information needed. Much additional information is urgently required on the current situation and future trends. This could be obtained through cross-sectional surveys of the pattern of breast feeding in representative communities in the world, using the same methodology and agreed definitions.

There is, therefore, an immediate need to devise appropriate field methods for investigating the social dynamics and epidemiology of breast feeding. The design of appropriate methods of investigation, including questionnaires, needs the combined expertise of the social psychologist, the anthropologist, the paediatric nutritionist and others. Logical preventive programmes, including appropriate cultural, social and economic motivations, can be based only on the results of such surveys.

4.5.2 Strategy. More detailed studies of the social dynamics of breast feeding will, it is hoped, lead to the development of more rational and effective ameliorative programmes; in the meantime, the following approaches should be pursued:

1) Education and propaganda. The vital significance of breast feeding until the baby is at least six months of age and proper introduction of nutritious supplementary foods need major emphasis as one of the main priorities in national policies, programmes and practices concerned with infant and preschool child feeding. At the same time, positive nutrition education is required, together with use through appropriate services of the most economical, nutritionally-adequate "emergency formulations". These facts must be channelled to training schools for all health personnel and nutritionists, and to those concerned with governmental nutritional and economic policy.

There is a great need for current information to reach medical schools and other training schools for health and other personnel, and to project the key role of human milk in modern nutrition.

The emphasis should be on the economic costs of failure to breast feed and the biochemical and immunological advantages of human milk as well as the dangers of artificial feeding for the less advantaged majority. The rising concern with the need to breast feed in modern life by educated women in the La Leche League International in the U. S. A. , and similar groups in Europe and Australia, can be an important aid to the development of such a programme of education and propaganda at all levels under the leadership of local women.

2) Processed foods. Foods donated for feeding programmes or special foods marketed for feeding young children must be introduced with due care that they do not have a displacement effect on breast feeding. The manufacturing, promotional and marketing activities of commercial infant food firms need careful scrutiny within the context of each country or region. As with other commodities, locally appropriate food standards and regulations need to be developed in relation to minimum permissible levels of nutrients and labelling and to prevent harmful advertising.

More positively, there is need for contact between those concerned with child nutrition in developing countries and the major infant food industries. This should permit frank exchange of views and suggest less harmful ways of channelling modern technological and marketing knowledge towards the production of nutritious and appropriate foods which are still profitable.

3) Maternal legislation. Direct encouragement of breast feeding must also be sought by appropriate legislation motivating and permitting urban and rural mothers, including those working, to breast feed. A search of current and past health legislation is needed, for example, on various forms of lactation leave and/or dietary or financial bonus, the development of creches or day-care centres designed to permit breast-feeding, and systems of supplying food to lactating mothers. The rational application of such legislation in developing countries is often difficult. If demands on industry are unrealistic, enforcement may not be feasible. If a short lactation leave is legislated, mothers may assume that breast feeding can be safely terminated at the end of that period.

4.6 The major need

The major overall need is to alert governments, health services, nutritionists and the food industry to the emergency situation likely to develop in urban areas in the near future. Its implications are not only the certainty of rising mortalities from almost epidemic marasmus and diarrhoea, but also the economic burden of curative services and of obtaining breast milk substitutes on a large scale, as well as the long-term consequences of the effect of recovered cases of infantile malnutrition on the intellectual level of the community.

Man's ingenuity is needed not only to devise new protein sources to bridge the increasing "world protein gap" but also to prevent the nutritional setback of declining breast-feeding, currently occurring insidiously and with little appreciation of its consequences. A cornerstone of any public health nutrition programme for the prevention of childhood malnutrition must be the need to promote an optimal lactation pattern in the community. Budgetary provisions must be made to devise effective public health programmes as an essential part of bridging the protein gap.

5. COMPLETE FORMULATIONS FOR INFANTS UNDER SIX MONTHS DEPRIVED OF BREAST MILK

In many areas of the world infants below six months of age do not receive breast milk. In developing countries this failure usually means a most precarious beginning of the child's development and is often the cause of early death. The number of infants who are deprived of breast milk is increasing dramatically, not only in urban but also in rural areas, and may continue to do so despite attempts to slow down or reverse the trend toward decline in breast feeding. There are several possible approaches to deal with this critical risk situation.

5.1 Milk-based formulas and the alternatives

While it is theoretically possible to prepare in the home, from a combination of plant foods, nutritionally adequate preparations for the infant under 6 months deprived of breast milk, in general this is not a practical public health approach to this problem at present. Modern science and technology are able to provide centrally-processed formulations based on vegetable proteins, such as the commercial soya-based formulations used in cases of milk allergy, which give quite satisfactory results in clinical testing in infants, even starting immediately after birth. Some of these formulations have also been tested in a few studies as the sole food for malnourished infants or infants recovering from malnutrition and have performed well. The production of satisfactory complete infant foods of this type presents special problems of formulation, processing and quality control; there has been vastly greater long-term experience with the use of milk-based formulas. Thus for some time to come necessary replacement of breast milk for infants under 6 months should be based primarily on animal milk. This view does not preclude the possibility of development and use of properly processed nutritious vegetable protein foods suitable for feeding infants under 6 months wherever such facilities exist. In areas where facilities currently do not exist, support and encouragement should be given to all efforts in this direction.

5.1.1 Milk supplies. Although there have been fluctuations from year to year in the supplies of milk products available for donation programmes, particularly with respect to individual countries, the current total supplies available to the World Food Programme and bilateral assistance are at an all-time high. In any case, the proportion of the available milk that would be required for younger infants in developing countries who are deprived of breast milk and can be reached with adequate supervision is relatively small. These needy infants should have the highest priority and all other uses should be secondary.

5.1.2 Home preparation of milk-based formulas. If fresh animal milk or full-cream milk powder (or milk or milk powder containing at least "half cream") are available, those responsible for the care of infants deprived of breast milk should be able to obtain these materials and be taught to prepare milk-based formulas properly (through addition of water and carbohydrates and boiling) and to feed them by appropriate techniques. However, this requires adequate supervision and teaching should be carried out in a sustained fashion.

5.1.3 Centrally-processed milk-based formulations. There are numerous relatively expensive milk-based formulations on the commercial market (29). In almost all cases the milk fat has been replaced by vegetable fat; the carbohydrate portion may also be modified. Almost invariably these products are marketed in tins and are sold in both liquid and powder form. Additional technology may have to be developed to enable distribution in lower-cost packaging.

5.1.4 Use of non-milk formulas. Promising new technological developments have shown the way for preparation of low cost formulas with only part, or none, of the protein coming from milk or other animal protein sources. The starch of cereal grain flour can be partially predigested by treatment with amylases or by cooking-extrusion processing. This improves digestibility, acceptance and tolerance for the younger infant and allows adequate caloric density of the final preparation.

5.2 Other desirable qualities

In the case of formulations intended for early weaned infants, careful attention has to be paid to the choice of ingredients, adequacy of testing procedures, the consistency of the final preparation for consumption, and the suitability and hygiene of the feeding utensil. The formulation should:

a) Contain all the necessary nutrients (probably including some lactose) in satisfactory balance.

b) Cost as little as is feasible, consistent with sound paediatric nutrition.

c) Be safe as to composition and also with regard to possibilities of microbiological problems in the use of the preparations.

d) Have appropriate prestige and status.

e) Require only simple preparation for consumption.

f) Be easily digestible without undue "bulkiness" in passing through the infant's stomach.

g) Have minimal breast feeding displacement effect in the community.

To satisfy criterion g), it is essential that the preparation is not promoted commercially in a way that will discourage breast feeding.

To ensure consumption of available supplies by the target infants, it may be preferable to have the preparations relatively unattractive to adults yet acceptable to infants. Acidified milks, which also offer some advantage with respect to microbiological safety, are in this category.

To avoid the problem of infection, the utensils used are of critical importance. Since bottles and nipples should be avoided, it may be advantageous to have a final preparation which is unsuitable for bottle feeding. However, both liquid and semisolid final preparations should be tried. Suitable feeding cups have been described by Welbourn and de Beer (30) who also describe a "feeding kit" which includes a dry formulation, containers for storage and utensils for preparation.

5.3 Locale of manufacture

The arguments for indigenous production are not as strong for processed infant formulas as for other kinds of processed foods intended for children in the weaning period and later on, because the infant weaned before six months of age covers a relatively short period of time and because the use of the product should be limited only to those infant groups which are under health control; the total demand could and should be kept rather limited. Even if this type of food had to be imported, it should not mean a heavy drain even on a precarious economy. Indeed, it would be a worthy objective of the World Food Programme and other international agencies to focus on this specific type of assistance.

5.4 Conditions of use

In order to ensure that these products will be beneficial and not cause harm certain prerequisites have to be fulfilled:

a) The mothers and their babies must be under constant supervision and carefully informed as to how to use the product, not only with respect to preparation, but also in the way of feeding including proper cleanliness.

b) Access to the product should be determined not by economic standards of the parents but by the true need of the infant. Ideally the product should be provided only to infants who fail to gain weight due to inadequate mother's milk supply. In these cases, the product should be given free of charge and in limited amounts at a time, covering the need for a week at the most. It is obvious that a programme of this kind can be carried out only by economic support from the government or the community and/or relief organizations. Furthermore, the distribution of the product should be through channels and services which can exert health supervision of the child (MCH centres, health centres, hospitals, orphanages, under the supervision of home economists, etc.).

c) When advertising products of this kind (infant formulas) great restraint should be observed and due consideration paid to the prevailing ecological situation. In at least one developed country (Sweden), leading producers of baby foods have, on advice of their medical consultants, agreed that processed formulas intended for infants below four months of age must not be advertised in the press. In a developing country, restraint with respect to promotional activities should cover at least the first six months of life. (Note: The problem of promotion in relation to infant formulas was discussed at a PAHO/WHO/UNICEF conference of paediatricians and representatives of the food industry on infant feeding in Latin America and the Caribbean, Bogota, 5-6 November, 1970).

5.5 Technology of manufacture, packaging and distribution

Breast milk should be the guide for proximate composition. However, the need for a fairly high proportion of fat may require packaging in tins or relatively expensive laminated bags, possibly under nitrogen. This can be avoided if it is feasible for the consumer to add the fat at the point of consumption. Alternatively, local mixing and rapid distribution, as in the case of the dry milk-sucrose-cottonseed oil mixture for treatment of kwashiorkor in Uganda (PAG document 10/28, 1960) may allow use of simple plastic bags. Further investigation is needed as to the feasibility of distributing fat-containing formulations in simple packaging when longer intervals between manufacture and consumption are necessary.

5.6 Testing requirements

Milk-based formulas of a composition similar to those which have been widely used would require minimal testing for nutritional value.

6. HOME - PREPARED WEANING FOODS

As long as adequate breast feeding continues, the infant is reasonably well protected, but the moment milk becomes insufficient, the young child enters a dangerous period of its life. The traditional society rarely has adequate special weaning foods suitable for feeding infants over 6 months and young children and in recent years efforts have been made to stimulate production of processed low-cost protein-rich weaning foods in developing countries. These efforts must be encouraged, but for a long time to come such products in most of these countries will reach only a small segment of the child population both for reasons of economy and marketing difficulties.

The avenue open for the vast majority of these children is better and more judicious use of locally available foods for the preparation of nutritious weaning foods in the home. The PAG is publishing a Manual describing home-prepared weaning foods and methods of feeding infants and young children (31).

7. INTRODUCTION OF PROCESSED PROTEIN - RICH FOODS

Experience has shown that introduction of processed foods without proper safeguards may cause more harm than good for large segments of the childhood population. Just as promotion of processed complete infant foods intended for formula preparation may cause mothers to abandon breast feeding, careless introduction of processed supplementary foods may also have an adverse effect on child feeding and child health. Also, the indiscriminate promotion of "western-style" baby foods in jars may cause mothers to spend their limited cash on these foods which might easily and inexpensively be prepared at home at a much lower cost. Distribution of imported supplementary foods may also act to hold back local efforts to manufacture and distribute such foods.

The following recommendations therefore seem warranted with respect to the situation in developing countries. The recommendations are intended primarily for processed, low-cost, protein-rich foods intended for older infants and young children (PAG Guideline No. 8, 1971). The points of view expressed are, however, pertinent also to "western-style" processed products intended for this age group and already widely in use in developing countries.

a) As a rule these products should not be recommended for infants below six months of age.

b) The introduction on the market and the promotion of these products should be carried out in close cooperation and contact with the health authorities, after obtaining the support of paediatric associations.

c) Whenever possible, products of this kind should be produced within the country. If they are imported, and especially if they are donated and intended for free distribution, great care must be taken not to weaken the interest and possibility of initiating production on a national level.

d) Simple but effective information with respect to the correct use of the product should always be found on the package or accompanying the package.

e) Products distributed through health centres, etc., should be available in the market.

f) In parallel with the introduction of products of this kind, efforts to improve education on nutritious home-prepared weaning foods should be intensified.

8. STANDARDS AND REGULATIONS FOR INFANT AND WEANING FOODS

The Codex Alimentarius Commission is currently engaged in drafting standards and regulations for infant foods. The standards should take into consideration regional variations, especially in the developing countries; stringent regulations can be introduced only gradually in those areas. However, legislation should aim at uniformity as much as possible, not only between countries but also within a country. For a protein food or for any infant food, community acceptability tests would often be at least as desirable as clinical tests. Similarly, the information given on the package should be clear, written in simple language and provide details on the source materials. The type of information given on the package is often so complex and confusing that it is difficult even for a nutritionist to decide the value of the preparation offered. The elaboration of codes for hygienic practice and microbiological standards for foods for children is being undertaken by the FAO/WHO food standards programme.

9. CHANNELS FOR INFLUENCING PRESCHOOL FEEDING

9.1 The four basic factors

Preschool feeding depends primarily on four factors:

1) Food availability, including cost, family income and facilities
2) Custom (cultural practices)
3) Individual family experience, attitude and responsibility
4) Realistic information provided to the family

Translating logical information into changed practice is a major obstacle in public health programmes. Personal service for the preschool child is a particular gap because he is not reached directly through schools or maternal-infant care activities. Much useful experience is available, however, not only from nutrition studies but also from community development, home economics, communicable disease and family planning programmes.

In developing areas, changes in knowledge, attitude and practice depend largely on person-to-person communication. Even in the areas reached by the limited mass media, the media have only marginal influence on populations which are semiliterate and habitually dependent on the opinion of their family, neighbours and community leaders. Agents of change must work through these community channels.

9.2 The local-level worker

Covering the numerous families and communities of developing countries with limited resources is a difficult task. Several principles to help in the planning are suggested in the following paragraphs.

The community contact must be community-knowledgeable, must accept the community and must be accepted by the community. This objective can be achieved by recruiting agents from the areas in which they are to serve and avoiding moving them too far away during their training. Priority should be given to in-service training, which should be the main function of supervisors.

An intimate and continuing community input is required to take advantage of vital informal information channels, to guide group dynamics, to influence gossip, and to counteract rumors and other negative influences. There must be ample opportunity for feedback; simple one-day information by a nutrition worker has little value. It is important to inquire into reasons for resistance to changing feeding practices.

Local-level workers can absorb and execute only a limited number of functions. Careful priority should be applied in selecting the functions they are to pursue, based on the local problems and the most efficient approach. The objectives must be limited to a few key changes rather than introducing a rigidly-structured, detailed, "optimal" feeding schedule.

In order to cover as many communities as possible with a limited number of workers, the latter must be multifunctional. Fragmentation of priority functions not only decreases the effectiveness of the worker but also requires duplication of personnel, facilities, transport and supervision.

Priority functions in many areas related to nutritional education include the management of pregnancy and delivery, including family planning, and the management of common diseases.

In countries where national planners are concerned with high population growth rates, and have recognized the need to rapidly cover the population with family planning information, the integration of nutrition functions can make both interests mutually supportive.

The auxiliary nurse-midwife, the local school teachers, community development agents and agricultural extension agents are examples of formal agents. Informal agents should also be mobilized; these may include the indigenous midwife, local healers, barbers, shopkeepers and religious leaders. When influential agents are not mobilized they are potentially serious negative influences. The successfully educated mother or the influential grandmother and the members of the family can in themselves be important informants for other mothers.

9.3 Higher-level workers

The functions of higher-level workers should focus on seeing that the right approach to the problem is used. This is done by supervision and training of local-level workers and by referring more complex questions to appropriate laboratory, research or information facilities. Whenever possible, physicians trained in paediatrics and/or obstetrics, who have the opportunity of coming into contact with children and mothers and whose advice is well received, should be associated with this work. They may require suitable training in modern principles of nutrition, with special reference to the regional nutritional problems and methods of overcoming them. Other professionals such as nurses, teachers, etc. should be made aware of effective approaches through contact with their supervisors and their organizations and training institutions.

9.4 Clinical contact

The first contact with the preschool child is in the maternity ward, where the mother is most receptive to education on the needs of her baby and how to accomplish them. Contact with the mother during pregnancy is also significant in influencing foetal and childhood nutrition.

The most common contact with preschool children is during the treatment of illness; it can be an opportunity when the mother is receptive to education. If education is not effective, nutritional problems are likely to recur. In all treatment facilities, including hospitals, the health worker must emphasize education of the mother along with the treatment of the child. If village-level workers can educate, in addition to offering simple treatment, many nutritional problems can be managed before they require expensive in-patient treatment. Furthermore, work in the local setting is more likely to be communicated between mothers and to have general community impact.

Attempts to adapt management so that treatment is less expensive and more effective are now under development in special nutritional rehabilitation facilities (32). These nutrition-oriented facilities also serve as good locations for training peripheral workers.

9.5 Resource facilities

Resource facilities in the form of institutions and experts are needed for contributing to the training of workers, for performing or guiding survey work where necessary, for laboratory analyses, and for providing technical information and guidance to workers. Such resource facilities can play a more effective role if they have a defined relationship to service and training units. Programmes should be planned so that each service and training facility has a designated resource facility.

9.6 Practical use of mobility

The efficient use of transport requires careful consideration. Mobile facilities are not only expensive but they are also likely to be lacking in impact on knowledge, attitude and practice, because they do not provide the continuity of service and the intimate personal contact required. In addition they suffer from problems of maintenance, lack of roads, and difficulty in following regular schedules. However, in certain special situations, the use of mobile transport is unavoidable.

On the other hand, transport is urgently needed for supervision and in-service training of peripheral workers. It can play a valuable role in special surveys. Under certain circumstances it is also useful for educational programmes and for distribution of supplies. In any case, it is best to use the simplest possible means of transport, which will have the fewest maintenance problems and will be able to get to the less accessible localities.

9.7 Commercial channels and government legislation

Stores are generally far more widely distributed than government health service units. Collaboration between nutrition programmes and commercial production and marketing has much potential. Governments can influence marketing policies and operations by providing information, and by appropriate legislation. The sale of food at a low price is generally of benefit to effective programme control.

The government can provide enrichment or fortification of foods, promote economic distribution of surplus agricultural products, lower taxes and other tariffs on good quality protein foods, tax nutritionally inappropriate products, and establish and administer laws regulating standards and codes of practice for hygiene, processing, packaging and labelling. Governments should consult with nutritionists, paediatricians and other concerned specialists on all these matters before introducing administrative changes.

9.8 Mass media

Mass media should not be neglected; they may have particular potential for influencing opinion of leaders and for conditioning the public favourably for person-to-person contacts. In some areas the transistor radio is one of the principal sources of information. The potential of mass media for public education on health and nutrition has not been properly exploited and considerably greater efforts should be made to work through these media using responsible production and advertising techniques.

9.9 Distribution

An obstacle to feeding programmes in many countries is inadequate government machinery to supervise food distribution. The machinery is likely to be less adequate through health channels than through school channels. Until this machinery is strengthened the available help of UNICEF, CARE, AID, the World Food Programme and other sources will have limited application.

The hidden costs that have appeared in distribution programmes have raised serious questions about the cost benefits of some distributions. Furthermore, it is apparent that creation of permanent dependence on outside supply may be undesirable. For these reasons distribution programmes need to maximize educational benefits and seek ways of phasing themselves out. Collaboration with international donor agencies such as the World Food Programme and Food for Peace is desirable.

9.10 Role of schools

The schools ordinarily do not reach the preschool child directly. In some cases the schools might be used as centres of distribution to mothers and preschool children and of parent education. However, the approach through school has the greatest potential in educating the oncoming generation and in using students to educate their families. The school garden and the school lunch are important for practical education.

9.11 Other channels

Women's clubs and youth clubs can be channels of information and distribution. Information can sometimes be channeled through industrial employment; this is of growing importance with rapid urbanization, but there are also rural opportunities such as tea estates, where female labour is particularly likely to be employed.

9.12 The urban contact

Several aspects of the urban problem must be considered. With curtailment of breast feeding consideration should be given to early supplementary feeding through clinics, day-care centres and home visiting. All staff involved must clearly understand, however, that for the large nonprivileged groups of young infants in developing countries no substitute will equal breast milk with respect to safety in rearing. Day-care centres and nurseries for working mothers offer opportunities for improving preschool nutrition. In the towns the population is more literate and has more access to mass media. Since more food is purchased, rather than home grown, greater attention should be given to influencing the food market availabilities.

9.13 Manual

The PAG manual, "Feeding infants and young children with special reference to homemade weaning foods", which is in publication will be a valuable adjunct in strengthening channels for preschool child feeding and will serve as a guide for semitrained workers. It will be of great use in the work of home economists, public health workers, skilled MCH personnel and medical officers in the developing countries who have the opportunity of using their contacts with mothers and children as a channel for nutrition and health education.

9.14 Effective preschool protection programmes

It is apparent that a number of new preschool protection programmes have been in operation with varying degrees of success in some parts of the world in recent years. The pooling of experience and the methodology employed in these programmes will be of great benefit.

9.15 Other channels

It is obvious that all these information channels have limitations and there is great need to develop more effective channels through constant research followed by trials and evaluations. At the same time, priority must be given to influencing agricultural practices, industrial-commercial modification and other factors that can influence acceptance through availability. A reinforcement of current approaches is also essential in order to have adequate impact. All these efforts will help long-term progress rather than pose dramatic easy solutions.

10. METHODOLOGY OF PRESCHOOL CHILD FOOD CONSUMPTION SURVEYS

10.1 The problems

Information on infant and child feeding practices and on the quality of diet is available for many countries, but data on the quantity of food consumed by this age group are scarce. A few quantitative surveys have been made, nearly all on a small scale and with limited geographical and time coverage.

Collection of data on food consumption of preschool children in developing countries presents problems of methodology. The more important of these are accurate evaluation of breast milk intake, food consumption from a common dish and frequent nibbling outside the home.

Lack of data on these items makes it difficult to measure the exact quantity of food consumed by an individual child. A relatively large number of trained interviewers are needed to carry out an accurate quantitative survey in this age group. There is need to establish a good rapport between the interviewer and the family and a companionship with the child so that items of intake and amounts may be correctly assessed.

Methods to be used will depend on the country and its culture as well as on the aims of the survey. A survey of preschool children should always be preceded or accompanied by studies of family food habits, family availability of food and other socioeconomic data that will help in planning applied nutrition projects.

10.2 Scope and methodology of food consumption surveys

Surveys on preschool children could be undertaken on a national basis, as a part of national food consumption surveys. In more limited areas, surveys conducted periodically as part of action programmes, such as applied nutrition programmes, will be of great aid in providing baseline data for planning and follow-up surveys for evaluation. Special surveys may be organized to study specific problems in preschool children in selected areas.

The methods available include:

a) Individual weighing
b) Recall technique
c) Questionnaires
d) Mathematical extrapolation from family surveys (33)

It is preferable to use a combination of two or more of these, depending on the scope of the survey and other circumstances. Irrespective of the approach, the survey, to be useful, should be associated with clinical and anthropometric surveys and where facilities exist, biochemical tests (34, 35).

There is an urgent need to carry out a large number of surveys covering the preschool child in as many regions as possible. The data collected through these surveys will help in the precise planning of action programmes for the benefit of the children, such as education programmes directed to mothers and families and the development of homemade or processed food formulas and supplements. An essential part of the survey is information on food habits and practices, on amounts of breast milk consumed and on local food supply and cost. Such periodic surveys will also enable an assessment of the value of nutritional programmes in the region.

10.3 The need for a guideline for methodology

Compilation of a guideline for methodology of food consumption surveys for preschool children will facilitate uniformity in procedures and data presentation and help in the comparison of the food consumption data obtained in different regions and in the same region at different times. It will also help in instituting proper training for the interviewers who form the backbone of such surveys.

11. NUTRITION SURVEYS

To provide a base for assessment of improvement of nutrition of preschool children and for the evaluation of action programmes, there is need for surveys combining biochemical, anthropometric, clinical and food consumption data with information on food economics and socioeconomic/sociocultural status. In many countries it will be necessary to study a number of cultural entities. Local institutions often can conduct the surveys but may need technical advice, support for training and perhaps additional financial assistance.

Longitudinal surveys are also useful, particularly if specific problems are being studied, such as some aspects of growth and development or to ascertain the role of nutrition in mental development and behaviour.

12. MILK INTOLERANCE AND NUTRITIONAL IMPLICATIONS

12.1 Milk intolerance in kwashiorkor

It has been known for a long time that a certain percentage of children suffering from kwashiorkor show poor tolerance to milk feeding during the initial weeks of treatment. The milk intolerance manifests itself in the form of diarrhoea and abdominal discomfort, though these symptoms do not markedly affect the recovery of the child if the milk feeding is continued. The symptoms subside gradually and after a few weeks the children begin to tolerate the administration of milk well. This milk intolerance has been related to disaccharidase deficiency during the acute stage of kwashiorkor and it seems to affect lactase activity more severely than other disaccharidases.

12.2 Milk intolerance and lactase deficiency in the general population

Recent investigations (36) have shown that in some apparently normal adults the intestinal lactase activity is low or nearly absent and administration of relatively large quantities of lactose or milk caused abdominal discomfort and diarrhoea. While this condition was observed in a small percentage of a few hundred Caucasian adults studied, it is reported to be more frequent among Asians and Africans. However, several of the studies reported in the literature have been carried out as clinical investigations in hospitals on small groups of subjects. Information regarding the occurrence of this problem in children is also meagre. Moreover, a lack of relationship between milk intolerance and intestinal lactase deficiency has been suggested. The scientific evidence available at present is too meagre to support a clear statement on the public health significance of the problem and its nutritional implications. However, in view of the current interest, the subject of milk intolerance with special reference to its nutritional implications and public health importance requires further consideration.

13. NUTRITION AND INFECTION

13.1 Introduction

The interaction between malnutrition and infection in the patient as well as in the community is complex and varies in extent and severity depending on several factors. Broadly viewed, together they constitute an epidemiological unit. The interaction between malnutrition and infection has been reviewed in earlier publications (37, 38), and it is stressed once again that it is not possible to dissociate the effects of infection and of malnutrition. The frequency of infection increases and tends to be prolonged and severe in children with malnutrition. Figures 1, 2, 3 and 4 represent the nutrition, growth and health history of four typical children in Guatemala, Ethiopia, India and Iran. It is of value to consider, both for prevention and treatment, a combined attack against malnutrition and infectious diseases. This has always been the practice in maternal and child health programmes but both aspects should be strengthened in appropriate balance and according to local priorities.

13.2 Collection of data

Governments should be better informed on the prevalence of malnutrition and its intimate relationship to the occurrence and severity of various infectious diseases. Appropriate information on the prevalence of malnutrition can come from two sources:

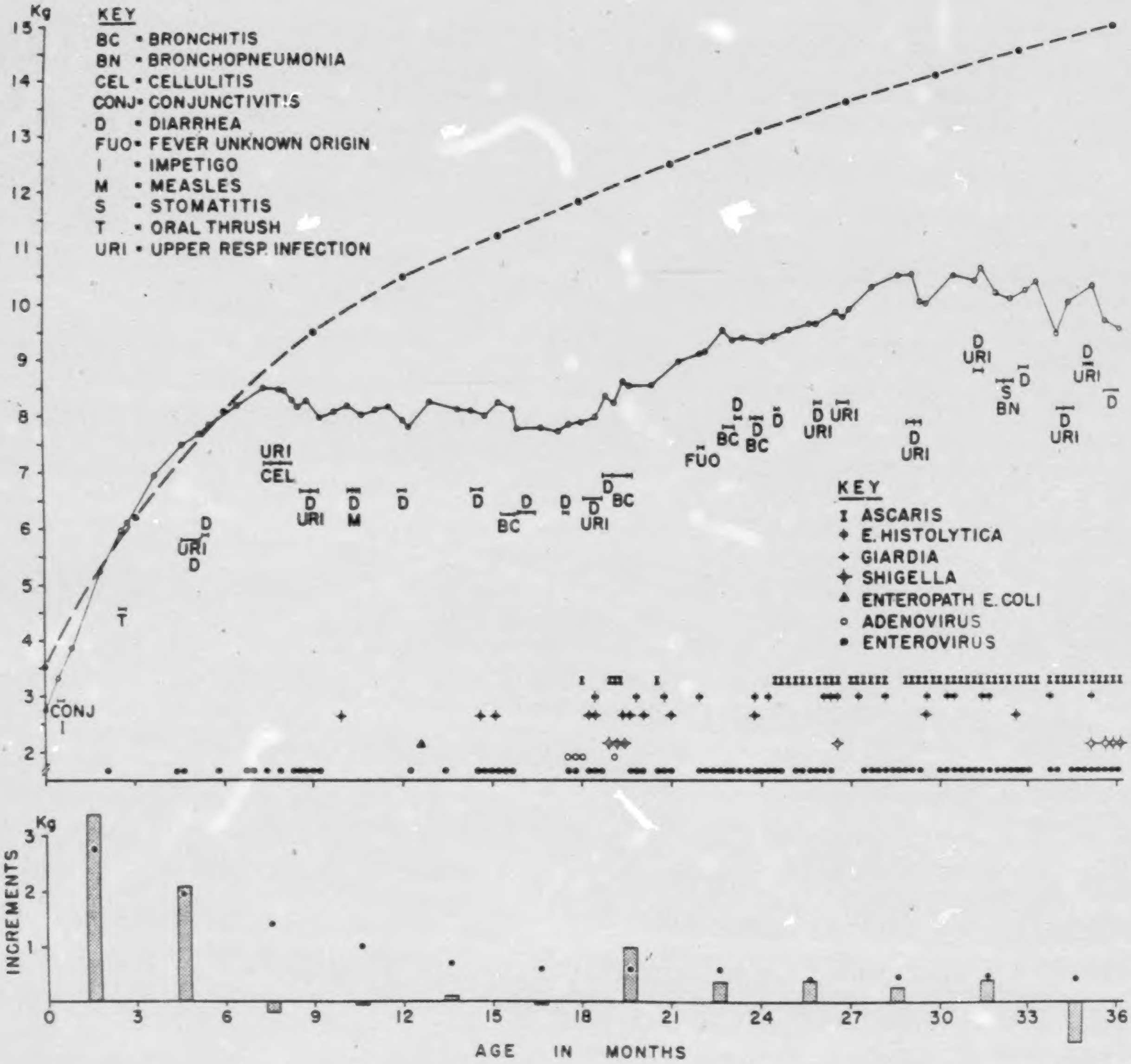
1) Registration of causes of mortality, most often limited to deaths in hospitals. In most cases only the primary cause of death is recorded and not the associated cause, e.g. malnutrition and/or anaemia, which may have been important factors in the death. Thus only advanced cases of PCM and anaemia, without concomitant infection, are registered as death due to malnutrition.

2) Nutrition surveys, mainly cross-section studies since they are cheaper and quicker. The examination of children, whose exact age is often unknown, may not reveal chronic moderate malnutrition which is characterized only by a smaller height for age. In some cases the malnourished child may on inspection appear well-proportioned (homeorrhesis). Although chronic moderate malnutrition aggravates the prognosis of common childhood infections and is of public health importance, in the results of some surveys only cases of advanced PCM are recorded. These represent only a small percentage of malnourished children.

13.3 The common problems

Common childhood infections are the ones which, due to their recurrence, constitute the main danger; they increase catabolism in malnourished subjects and often prove fatal. Among them diarrhoeas and respiratory diseases are the most common and, unfortunately, there is no possibility of immunization against these common ailments.

FIGURE 1



INCAP 70-307

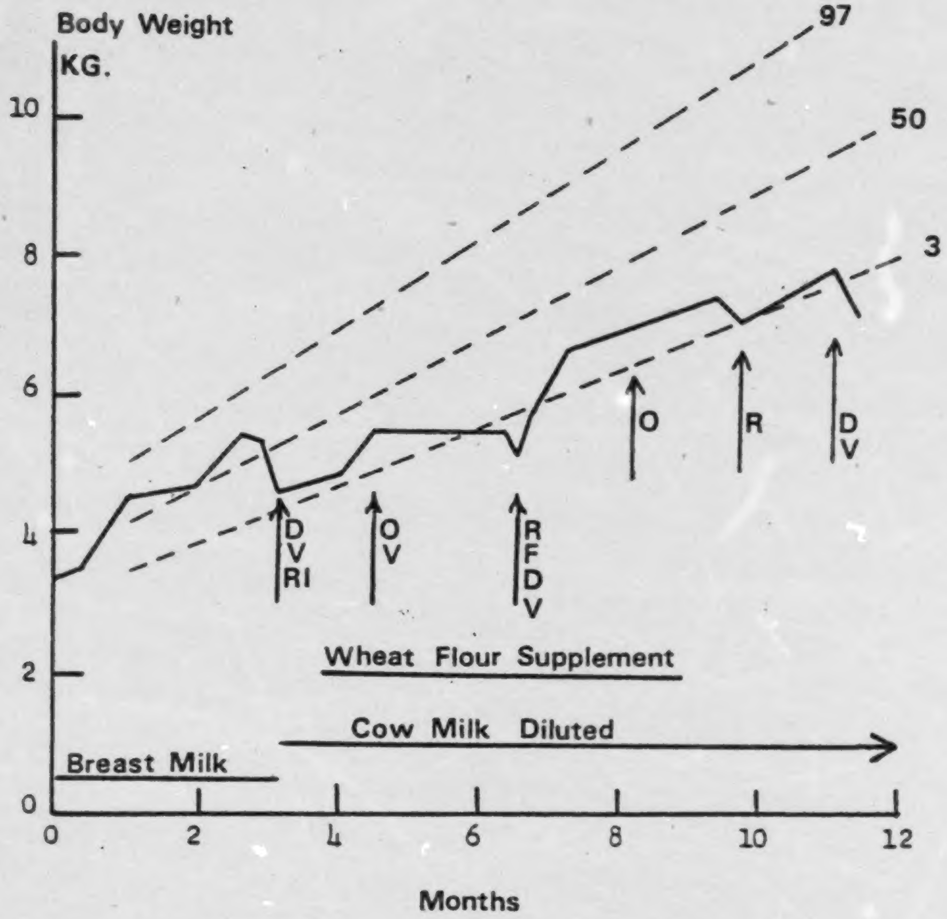
KEY :

Top: The solid line represents weight of child; the broken line is the median of the standard. The length of each horizontal line indicates duration of infectious disease. Each mark shows a week positive for the particular infectious agent.

Bottom: Observed weight increments (vertical bars) and expected median increments of the standard.

FIGURE 2

Case No. 4, ♀
Ethiopian Child

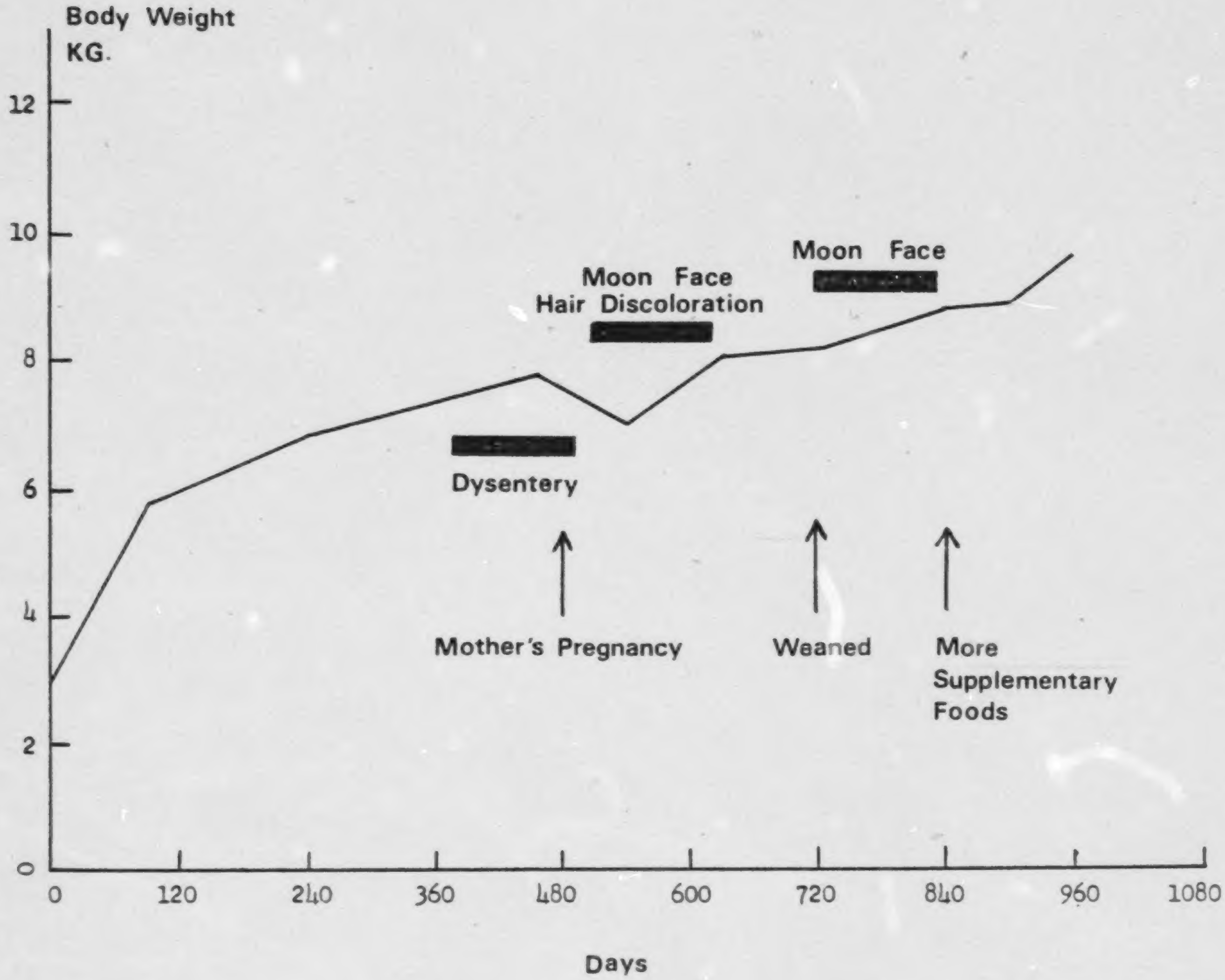


From A Study By Roland Eksmyr,
Ethiopian Nutrition Institute, 1969

D	Diarrhoea
F	Fever
O	Otitis
R	Rash
RI	Resp. Infn.
V	Vomiting

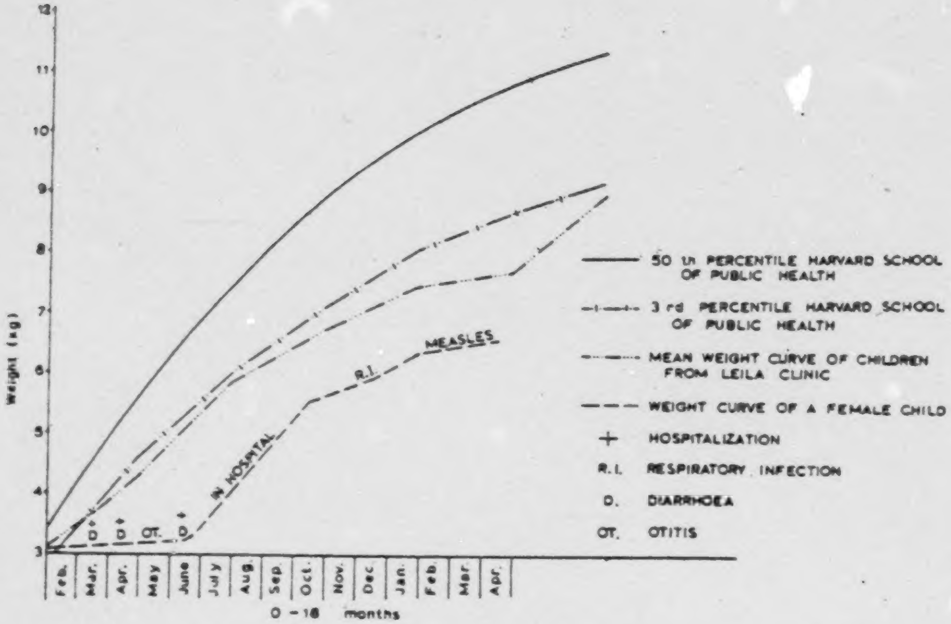
FIGURE 3

Case No. IC ♀
Indian Child



From Annual Report, National Institute of Nutrition
Hyderabad, India, 1962, p. 39

FIGURE 4



WEIGHT CURVE IN RELATION TO INFECTIOUS DISEASES IN A FEMALE CHILD - IRAN

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Special consideration should be given to malaria, which affects the nutritional status of the population in the endemic areas, and to measles, whooping cough, infections of the skin and chickenpox, all of which seriously undermine the nutritional status of the child.

There is evidence that severe helminthic infestation may lead to harmful effects on host nutritional status. Ankylostomiasis forms a real nutritional hazard through constant loss of blood, leading to loss of protein, iron and possibly other nutrients. This assumes significance in preschool child nutrition, since in certain parts of the world heavy hookworm infestation is reported to be present in infants and young children. Similarly, infestation with ascaris, especially with a high worm load, may aggravate malnutrition largely by disturbing digestion and absorption of all nutrients and particularly proteins. Further scientific information is required on the nutritional effects of these and other helminthic infestations, particularly the relationship between worm load and nutritional effects, and with regard to the latter, the extent and quality of the effects. The mechanisms by which these parasites affect the host nutrition also need to be studied. It is the clinical opinion of paediatricians in many parts of the world that giardiasis in infancy and early childhood is a serious cause of diarrhoea and malabsorption and the nutritional significance of this parasite lies in the fact that it is difficult to eradicate completely, resulting in frequent episodes of alimentary upset.

13.4 The solution

Ideally, the solution to the problem would be to carry out all the necessary measures simultaneously:

1) Immunization against specific diseases: measles, whooping cough, smallpox and tuberculosis

2) Improvement in sanitary conditions, primarily the supply of safe drinking water

3) Appropriate diet and nutrition education in order to ensure good nutritional status and maintain resistance against infectious diseases and any eventual injury.

In the long run, improvement in sanitary conditions should give the best results, but it is very difficult to carry this out successfully. There is evidence that unhygienic food handling at home is probably one of the most important factors in weanling diarrhoea.

The results of immunization are often difficult to evaluate. It would therefore be of interest to study them in a given region according to the nutritional status of different groups of children and to the local ecology. The vaccination campaigns should be planned according to the local pattern of epidemics and the resources available. For example, a vaccination campaign against measles should be repeated regularly for it to be efficacious. The effect of the vaccination programme on child mortality and morbidity may be partly masked if the children of the area continue to suffer from episodes of common respiratory and intestinal diseases, due to the poor sanitary conditions of their environment.

13.5 Research areas

An important problem is the reaction of malnourished children to the tuberculin test. In several countries it has been shown that malnourished children suffering from tuberculosis react positively only to high doses of tuberculin (39, 40). The problems of nonspecific tuberculin reactions and their interpretation are areas for further study. Further studies are also needed on the effect of PCM on defense mechanisms. The results of the few studies carried out so far seem to show that there might be a means of evaluating the frequency and effect of infections in malnourished children.

In the estimation of recommended intakes of nutrients, the FAO and WHO have so far concerned themselves with children in good health. In tropical countries, however, infectious diseases and episodes of infection are so frequent that in interpretation of recommended intake this factor should be taken into account and suitable increases in recommended allowances should be made.

14. SPECIAL MIXTURES FOR TREATMENT OF PCM AND FOR USE IN SUPPLEMENTARY FEEDING

14.1 In the early days of treatment of acute protein-calorie malnutrition the addition of casein and sucrose to skimmed milk powder to obtain a mixture with reduced lactose produces better results (41, 42). Addition of fat to these mixtures is necessary to provide adequate calories.

14.2 K-Mix-II

General application of this procedure is difficult, due to the relatively high cost of the pharmaceutical grade of casein used in earlier studies. Recently, however, a mixture of "food-grade" calcium caseinate 3 parts, skim milk powder 5 parts and sucrose 10 parts (by weight) called K-Mix-II, has been supplied by UNICEF for use in Nigeria. In the first half of 1970, 400 tons of this mixture were provided. Excellent response to this mixture with added groundnut oil has been reported (43). The "food-grade" calcium caseinate is of a quality which allows easy preparation of a suspension in water plus oil and easy passage of the suspension through a naso-gastric feeding tube, if necessary.

14.3 PKFM

Another mixture which has proved useful in feeding children recovered from kwashiorkor is a precooked, sweetened, fortified maize flour - soy flour mixture, called "post kwashiorkor feeding mixture" (PKFM). Eight hundred and fifty tons were supplied to Nigeria in the first part of 1970 and an additional 3,000 tons towards the end of 1970.

PKFM is a fully precooked, ready-to-eat high-protein mixture formulated as follows:

Corn (maize) meal	40%
Full fat soy flour	38%
Dry skim milk	5%
Sugar (sucrose)	15%
Vitamin-mineral mixture	2%
Added vanilla flavour	

Dry PKFM contains 20% protein and 8% fat and it provides 113 calories per ounce (4 calories per gramme). It is readily accepted due to the sweetness of the sugar component, the fat level and the added flavouring. It requires no cooking and for feeding it needs only to be mixed directly with water which has been boiled. Fairly concentrated preparations may be fed; for example, one volume of the dry mixture to one and one-half volumes of water. In any case, adequate water intake must be maintained.

14.4 Other useful mixtures suitable as supplementary weaning foods have been tested in limited trials and are listed in the report on "Consultation on human testing of protein rich foods" (WHO, Geneva, 9-11 March, 1970).

15. PRESCHOOL CHILD FEEDING IN TIMES OF DISASTER

15.1 The precarious situation of the preschool child

In times of disaster as at other times it is the children of preschool age who suffer most. Even at "normal" times in developing countries the vast majority of preschool children, especially in the age group six months to three years, are in a state of chronic malnutrition. Famine conditions will severely strike these dependent young children, who are already in a precarious situation, leading to a great increase in morbidity and mortality in this age group. The nutritional requirements of this age group are relatively high, not only in quantity but also in quality, e.g. with respect to protein. At the same time the young child is completely dependent on adults to help him meet these needs. In a famine situation, social and family disruptions may leave the child isolated and helpless, even when not actually abandoned. Infectious diseases and gastroenteritis add to the plight. A systematic surveillance carried out in the Uyo area of Nigeria during the recent famine revealed that children under four years of age represented nearly 60% of the total of those suffering from malnutrition (44).

15.2 The effect of relief programmes on the preschool child situation

Almost any type of relief programme including food assistance will have at least some benefit for the young child directly and/or indirectly. This is true if the assistance is provided in the form of cereals, pulses, oil, sugar, dried fish, etc.

However, the younger the child the greater the need for special foods which provide the necessary amounts of good quality protein, vitamins, etc. For a long time the mainstay for this purpose has been dry skim milk powder and in later years the same enriched with vitamins A and D. It continues to be so, especially for the preparation of complete foods for infants who are prematurely weaned.

In recent years special low-cost protein-rich foods based mainly on vegetable products and providing an ample supply of vitamins and some minerals have come on the market. These foods have excellent supplementary food value and are intended for use especially as a weaning food. During the Nigerian civil war large quantities of CSM (a corn-soya-milk mixture fortified with vitamins and minerals) were shipped and proved of definite value in child feeding programmes. Programmes using imported weaning foods may be vital in periods of famine. Even so, mothers should be taught how best to use the few staples available locally for the production of homemade weaning foods.

Breast feeding, extremely important under ordinary conditions, becomes vital for the child during famine. Thus an essential part of the relief to benefit the child is to give pregnant and nursing mothers high priority in the feeding programmes.

The most vulnerable individual in times of disaster is the artificially fed infant below six months of age. Without special measures he will succumb in a matter of days. Therefore, all infants not breast fed should have the highest priority in relief programmes.

The administration and execution of food relief programmes can to a great extent be carried out by nonmedical personnel. However, experience from recent famines underlines the importance of establishing "adaptive MCH services" and special "famine hospitals" which serve as centres for emergency care, for checking panic and also initiating immunization programmes and other measures to protect against epidemics.

15.3 Machinery for implementation

A summary of the recommendations made in a recent symposium on nutrition and relief operations in times of disaster held in Sweden (45) is given below:

1) National governments and international organizations should establish a convention or modify the existing conventions and outlaw starvation as an instrument of conflict. This would be in line with the ban that has been imposed on bacteriological warfare.

2) A system for warning of impending famine should be worked out making use of existing extension channels (reports on crop failure, increase in food prices, population movements, sudden rise in incidence of malnutrition and of young child mortality). The data obtained should be made available without delay to the national governments.

3) A national coordination body should be established, charged with predisaster planning and coordination of external and internal aid in times of disaster.

4) A permanent secretariat should be established on an international level charged with the task of keeping up-to-date records on available relief resources and collection of data relevant to the prediction of impending disaster. Furthermore, a special expert analysis group

comprising specialists in management, health, nutrition, agriculture and the social sciences should be organized on a headquarters level. Such a group should be immediately available on alert both for advice in planning relief operations and for visits to the disaster area.

5) As part of the training of personnel for relief operations in times of disaster, special survey teams should be organized with instructions on how to collect anthropometric and dietary data both on preschool children and on older children and adults. Such teams, supervised by national institutes of nutrition and/or regional United Nations organization offices, could be of great value not only to evaluate the relief programmes but also for use in normal times.

6) A manual on nutrition relief operations should be prepared.

16. NUTRITION IN MEDICAL TRAINING

There is a serious need to improve the nutrition training of medical personnel, especially with respect to the needs of the preschool child and practical ways to meet them. Paediatric curricula should shift to broader considerations of MCH coverage and should stress preventive medicine and nutrition. Field training in urban slums and rural areas is needed. In this connection, reference should be made to the fact that the International Paediatric Association (IPA) held a workshop at the last congress in Mexico City, December 1968, devoted to paediatric education in which child health problems related to developing countries was given special attention. Furthermore, the IPA has announced a special workshop on nutrition at the forthcoming congress in Vienna to be held in August 1971.

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Summary

PAG AD HOC WORKING GROUP MEETING ON FEEDING THE PRESCHOOL CHILD

The third ad hoc Working Group Meeting on Feeding the Preschool Child was held at the Pan American Health Organization Headquarters, Washington, D.C., on 26 to 28 October, 1971. The members of the Group were Professor Bo Vahlquist, Sweden (Chairman); Professor M. Gabr, Egypt; Dr. O. Ballarin, Brazil; and Professor P. Satgé, France. Dr. V.K. Tatochenko, U.S.S.R., was not able to attend. Dr. Martin Forman, U.S.A., attended the meeting by special invitation. The representatives of the Agencies were FAO, Dr. G.D. Kapsiotis; WHO, Dr. J.M. Bengoa; UNICEF, Dr. L.J. Teply; IBRD, Mr. Charles Weiss; and WHO/PAHO, Drs. R. Rueda-Williamson, J.G. Chopra, B. Bosley, R.R. Puffer, C.V. Serrano and D.B. Jelliffe. Dr. Katherine Bain, U.S.A., Mrs. Patrice Jelliffe, Jamaica, and Mr. S. L. Pearson, UNICEF Consultant, attended the meeting as observers. Dr. Max Milner and Dr. P.S. Venkatachalam represented the PAG Secretariat. Professor N.S. Scrimshaw, Chairman of the PAG, also attended the meeting.

The ad hoc Group considered among others the following subjects relevant to feeding the preschool child in the developing areas of the world: a) causes of infant and childhood mortality, the methodology of measurement and nutritional and health implications; b) criteria for identification of mothers and preschool children at risk of developing malnutrition; c) nutrition rehabilitation centers; d) water requirements of infants and e) acidified and fermented milk for feeding infants and children.

In discussing infant and child mortality in developing areas of the world, the Group felt that the decline in mortality in children under 5 years of age that is being observed in many countries, unless carefully examined, may suggest that the nutritional situation is improving much more rapidly than is really the case. Actually, the available evidence indicates that the decline in mortality is probably due more to specific public health action to prevent deaths than to any improvement in the overall standards of living, including the general nutritional condition in the country. The present situation in developing countries seems to be very different from the situation of developed countries 30 or 50 years ago, where the drop in mortality probably was due mainly to the improvement in the standard of living. Under these circumstances mortality rates alone may not be a satisfactory criterion of the nutritional health of the community.

Mortality studies in children using the multiple-cause approach have provided useful data on the epidemiology of malnutrition, the close interaction of nutrition and infection, and the association between environmental factors, malnutrition and mental development. The multifactorial causality present in child mortality should be noted by public health workers as an indispensable basis for planning and development of preventive programs to protect mothers and young children, the most vulnerable groups of the population.

The role played by malnutrition of both the mother and the child in child mortality and morbidity is now more clearly recognized than before and this is sufficient justification for assigning high priority for nutrition activities, within the context of comprehensive MCH programs.

Since the patterns of mortality and the associated conditioning factors present wide variations from one place to another, it is essential to consider the specific characteristics of the problem and the local situation before planning and developing public health programs to lower and/or prevent the high rates of childhood mortality. However, some basic conclusions from epidemiological studies in children are applicable as general principles to any program for preventing the deaths of children and ensuring for the survivors good health and the full attainment of their genetic potentialities of physical growth and mental development.

The concept of identifying the child, the family or a community as one exposed to the special risk of development of malnutrition, using what are known as "at-risk" factors, was discussed and the value of this approach in special situations was recognized. It was noted that this subject is the title of a special meeting to be held by IUNS in 1973.

The types of nutrition rehabilitation centers, their activities and evaluation were discussed and the Group concluded that the centers are a useful component of a general network of services, which are all aimed at preventing and treating malnutrition in the vulnerable preschool child age group. (This subject was further discussed in great detail at the 19th PAG meeting; see p. 3).

The subject of water requirements was considered separately, for the normal infant, the malnourished child and the dehydrated child. The Group noted that in spite of many reports on water requirements of dehydrated infants and children, there is not much information on the water needs of normal and malnourished infants. Although some general recommendations were made, the Group suggested the need for further research in some of the important areas where information is lacking. The available information on the production and use of acidified and fermented milk was reviewed. The Group noted that although there are certain benefits in their use for infant and child feeding and the products are extensively used in the U. S. S. R. for this purpose, their use presents certain problems in many countries. The claims of the beneficial effects of acidified milk also deserved further investigation and confirmation. The ad hoc Group also made a recommendation for further research on each of the topics discussed at the meeting.

(The full report of the ad hoc Working Group meeting is available as PAG Document 1.14/26).

Protein Advisory Group
of the
United Nations System

Preschool Child
Document 1.14/26

18 February 1972

REPORT OF THE THIRD PAG AD HOC WORKING GROUP MEETING ON FEEDING THE PRESCHOOL CHILD

Washington, D.C., U.S.A., 26 - 28 October 1971

1. INFANT AND CHILDHOOD MORTALITY

NUTRITIONAL AND HEALTH IMPLICATIONS

In discussing the present situation of child mortality in developing areas of the world, it was recognized that, although the quality of vital statistics is not satisfactory, an important decline in mortality in children under 5 years of age is being observed in many countries. Unless carefully examined, this decline in mortality may suggest that the nutritional situation is improving much more rapidly than is really the case. The available evidence indicates that the decline in mortality is probably due more to specific public health action in preventing deaths than to any improvement in the overall standards of living including the general nutritional condition of the country (1). The present situation in developing countries seems to be very different from the situation of developed countries 30 to 50 years ago, where the drop in mortality was probably due mainly to the improvement in standards of living. Under present circumstances, mortality rates alone may not be satisfactory criteria of the nutritional health of the community.

1.1 Inter-American investigation of mortality in childhood (2)

The discussion was based on the results of the above study, developed in fifteen widely-separated areas of the Americas. This is a continental collaborative study carried out under the sponsorship of the Pan American Health Organization, with the objective of developing valid and comparable statistics related to causes of death in children under 5 years of age. Although there is a wide variation in the prevailing conditions from region to region of the world, some of the findings and conclusions of this study might be applicable to other regions and countries. The methodology of the study is also applicable to other areas of the world.

1.2 The method

The starting point of the investigation was the occurrence of a death of a child under 5 years of age known by the use of official and nonofficial sources in each area. A visit was made to the home of the family by a public health nurse or a social worker with the purpose of obtaining information on environmental conditions, family composition, previous deaths in the household, reproductive history of the mother of the study child, age, education and occupation of the parents, nutritional history and a summary of the medical attention provided the deceased child from birth to death. A physician interviewer collected all pertinent medical information available from hospitals, clinics, private physicians and autopsy records as well as from the family of the dead child if necessary. The medical part of the official death certificate was transcribed and the questionnaire completed with a final summary and a statement of the multiple causes. The phase of data collection of deaths extended over a period of 24 consecutive months.

1.3 The results

The investigation has confirmed that mortality of children under 5 years of age is excessive in the Latin American projects, being higher in the rural areas than in the cities. Infant mortality is high, due principally to excessive postneonatal mortality, a consequence of environmental and sociobiological factors. In the second year of life death rates are also relatively high in some urban and all rural areas. Although the death rates in the 3- and 4-year old children are excessive compared to those in developed countries, numerically the problem is overwhelming mainly in the first two years of life.

Using the multiple cause approach, it was possible to evaluate for the first time the extent to which causes such as nutritional deficiency and immaturity contribute to mortality. Through this approach and also through measurement of sociobiological and environmental factors, the investigation was able to establish important interrelationships towards better understanding of the causes of mortality at the community level so that guidelines for sound planning in maternal and child health could be defined.

It was found that within the broad group of infective and parasitic diseases, diarrheal disease constituted the main underlying and associated cause in children under 5 years of age, and was particularly serious in children under 2 years of age. Measles mortality was exceedingly high in some areas as revealed by the investigation. The death rates due to this disease in children 1-4 years of age exceeded those of diarrheal disease in some areas. Except in the Santiago area, the vaccination coverage against measles was essentially negligible in localities where the deceased children were studied. This underlines the urgent need for introducing and maintaining successful vaccination against this disease within the context of integrated MCH programs. Mortality from measles has also been found to be closely related to the nutritional status of the child. The synergistic action between infection and nutritional deficiency has been clearly brought out once again through the study of multiple causes.

The close relationship between nutritional deficiency and mortality from all causes in children under 4 years of age was clearly demonstrated by the data. Nutritional deficiency was frequently an associated or underlying cause of death among infants in urban, suburban and rural areas. The rate was twice as high as that for the second year of life in the same areas. This clearly suggests that nutritional deficiency is more serious in early life and that effective action to prevent malnutrition in the prenatal and early life period is indicated. Mortality due to nutritional deficiency was generally higher in rural than in urban areas.

In the areas included in the study the marasmic type of malnutrition was found more frequently as an underlying or associated cause of death in infants under 1 year of age, while a predominant protein deficiency (kwashiorkor type) was the more frequent underlying or associated cause in children between 1-4 years of age.

There seemed to be an inverse relationship between length of breast feeding and mortality from diarrheal disease. Further studies are necessary to establish this relationship on a firm basis. Among the environmental factors, nonavailability of clean water for drinking and personal hygiene were found to be significantly related to mortality from diarrheal disease.

1.4 Implications for nutrition programs

It was recognized that the results of the Inter-American Investigation of Mortality in Childhood, as well as other types of epidemiological studies currently underway, such as those being undertaken by INCAP and other nutrition groups in the world, have yielded useful data on the epidemiology of malnutrition, the close interaction of nutrition and infection, and the association between environmental factors, malnutrition and mental development. The multifactorial causality present in child mortality should be noted by public health workers as an indispensable basis for planning and development of preventive programs to protect mothers and young children, the most vulnerable groups of the population.

The role played by malnutrition in child mortality and morbidity is now more clearly recognized than before and this is sufficient justification for assigning high priority for nutrition activities, within the context of comprehensive MCH programs. Since the patterns of mortality and the associated conditioning factors present wide variations from one place to the other, it is essential to consider the specific characteristics of the problem and the local situation before planning and developing public health programs to lower and/or prevent the high rates of childhood mortality. However, some basic conclusions from epidemiological studies in children are applicable as general principles to any program directed to prevent the death of children and to ensure for the survivors good health and the full attainment of their genetic potentialities of physical growth and mental development.

The optimal health condition of the mother is essential for the growth and development of the infant and therefore, programs should begin from the time of conception. A comprehensive maternal and child health program should place emphasis on the fulfillment of the following three objectives: prevention and control of nutritional deficiency in mothers and children, prevention of infectious diseases and family planning.

Children under 2 years of age should be considered the group at highest risk, and therefore should deserve the highest priority in MCH programs. The active promotion of breast feeding and the education of mothers in aspects related to infant feeding, including types and preparation of weaning foods, are essential elements in the prevention of malnutrition. It was recognized by the Group that special emphasis should be placed on decelerating the current trends toward early weaning. The effectiveness of these activities will depend on the quality and availability of services such as prenatal care.

The provision of supplementary feeding using village-level multimixes, locally-processed foods and imported foods to selected pregnant and nursing mothers and children under five years of age should be considered a high priority and an integral part of comprehensive MCH programs. Extensive effective immunization programs against measles, smallpox, poliomyelitis, diphtheria, tetanus, and whooping cough should always be included in any comprehensive MCH program. Vaccination against measles deserves the highest priority in developing countries. Programs of environmental sanitation, including piped water supplies and toilet facilities, in conjunction with programs of health education geared to the family, are essential for the prevention of diarrheal diseases and malnutrition.

Health services in general and comprehensive MCH programs in particular, including family planning, should place special emphasis on the extension of their coverage to rural areas. For the extension of these services, increasing use of auxiliary personnel and particularly the active participation of the community by voluntary members is strongly recommended. The participation of these personnel in health activities at the home level will be valuable. The above programs should be closely coordinated and developed within the frame of comprehensive health services for the community.

There are many shortcomings and limitations of health services for the care of mothers and children. There is not only the need to improve the recording of vital and hospital statistics essential for planning and evaluation of health and nutrition programs but also the need to increase the availability and utilization of health services and sanitary facilities. It is necessary to establish simple methods of registration and reporting of deaths of children which include identification of causative factors as underlying or associated. Methods used in the PAHO investigation should be properly adapted to local prevailing conditions and resources and applied in other areas. The methodology as well as the findings should be used to stimulate action leading to the development of comprehensive and coordinated MCH program, definition of areas of operational research and organization of teaching activities in health sciences including schools of medicine, public health and nursing.

2 AT-RISK FACTORS AS AN AID IN MALNUTRITION SURVEILLANCE

2.1 The concept

Attempts to recognize individuals, families or communities who are "at-risk" (or "high-risk") in relation to developing a particular illness have formed a subconscious part of the philosophy and practice of medicine and public health for centuries. This type of approach has great relevance today to nutritional surveillance, especially in the identification of the individual, family or groups who are at special risk so that necessary measures can be initiated to prevent the development of severe malnutrition. This preventive approach is concerned with the definition of practical biological, environmental or other factors that indicate that the units under consideration, whether children, families or nations, are at special risk or in danger of developing malnutrition. These indicators will help to identify and direct priority attention to the special risk groups. The at-risk (or high-risk) concept can be applied to children; to pregnant and nursing women; to families; to communities; to countries; and to different seasons of the year. Examples can be given on a macro-scale, involving large populations as in nations or regions, or on a relative micro-scale among children attending health services.

2.2 Surveillance of children

The biological or environmental circumstances which predispose a young child to malnutrition will constitute early warning signs that severe malnutrition may be impending. In order to be effective as a tool for surveillance the at-risk factors must be defined and selected so that they are practical, useful and relevant to the particular local ecology. They should also be limited in number and based on the patterns of malnutrition and its determinants in the area. When properly selected and used they offer a practical possibility of providing preventive action in the form of supervision and special care or supervision only, without overwhelming the health services, until such time as the children are no longer at-risk. They must be simple, objectively recognizable and usable by all levels of health staff.

Some at-risk factors have been listed (Table I) as an incomplete list of examples from which more locally-relevant priority factors will need to be selected and others added.

Careful surveillance of young children of sufficient closeness to detect at-risk factors can only be undertaken if home-visiting facilities exist. For the latter, volunteers could be made use of wherever feasible.

Universal examples of biological at-risk factors in relation to young child malnutrition include low birth weight and growth failure (as indicated by flattening of the weight curve); environmental circumstances include extreme poverty and an "incomplete" family (absence of the father or mother).

In all countries, there is a need to devise a small number of carefully-selected, more locally-significant at-risk factors (forming at-risk profiles). On a world scale, a great deal of information is currently available concerning at-risk factors in different communities, and it would be valuable for an interchange of such knowledge to be organized. This could lead to practical guidelines designed to assist field workers in the selection of at-risk factors most appropriate to their region. The ad hoc Group was aware that arrangements are being made to organize an international meeting on this aspect, under the auspices of the International Union of Nutritional Sciences, in 1973. The Group considers this an important meeting and is looking forward to its deliberations and conclusions.

2.3 Surveillance at the community level

The indicators chosen must reflect the important causes of malnutrition in the specific area under consideration, such as low purchasing power, unemployment, and limited agricultural and livestock resources. Data on the pattern of conditioning infections and the range of drugs available to combat and prevent diseases will also be useful indicators. Since they vary both in degree and prevalence in different

TABLE I

SOME AT-RISK FACTORS IN PROTEIN-CALORIE MALNUTRITION OF CHILDHOOD

BIOLOGICAL	Young child	Twins. Low birth weight. Some congenital abnormalities, e.g. cleft palate Close-spaced (<2 years). Large family size. High birth order Transitional period (often second year) Age range of maximal mortality Growth failure (weight curve; other anthropometric indices) Signs of malnutrition Infections (measles; diarrhea; whooping cough; "non-immunized") Family history (previous weanling deaths; previous malnutrition) Health status of other siblings, family history of disease (genetic, metabolic, infectious or otherwise)
	Mother	Maternal illness and malnutrition (e.g., maternal height) Maternal presence. Maternal age (young or old). Maternal infections (malaria and low birth weight). Maternal death. Maternal intelligence/competence
ENVIRONMENTAL	Culture	Weaning practices (age; suddenness; separation; associated traumatic practices) Weaning food Child feeder Mother working Sex of child Traditional practices with infections. Newly urbanized
	Socioeconomic	Economic level (relation to protein supply for young children in each economy, especially urban) Educational considerations (literacy; language barriers) Incomplete family (absence or inadequate support by father; death or temporary or permanent absence of mother) Abandoned children Alcoholism
	Geographic-Climatic	Seasonal (special relation to weaning) Geographically distant
	Miscellaneous	Nonattenders at health services

areas of the world the indicators should be carefully chosen, so that they prove their usefulness when results are evaluated after a few years. The indicators chosen must be few in number, must reflect actual and predictable trends in malnutrition patterns, must be easy to collect, and must provide, as has been already mentioned, useful and meaningful results. These indicators must be sensitive ones and must include seasonal variations in patterns of malnutrition. Ideally, internationally-applicable indicators would be preferable, but this is unrealistic as the causes of malnutrition are variable in different ecologies. The most practical answer might be to devise a schematic nutritional profile.

Some of the indicators which could be usefully applied for identifying communities with high incidence of malnutrition are given in the footnote*.

In order to make the indicators meaningful, certain basic data must be obtained, such as the correct date of birth and anthropometric measurements. It is preferable to obtain results from a community survey but this is more time-consuming and difficult than using results obtained from a hospital child population sample. Medical and public health indicators will give information on at-risk factors at the community level, while socioeconomic indicators will show possible pathways of intervention if such exist.

It is essential that one be aware of the difficulties in the selection and use of at-risk factors since the indicators chosen must reflect patterns applicable to the country as a whole, and not only to privileged areas such as a capital or a large city, and must be capable of demonstrating their usefulness when evaluations are done after some time. Data will also have to be collected by different disciplines and the physician, whose primary role is to evaluate medical conditions, may not always be able to fully interpret the various results sent to him.

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*Some medical and public health indicators

a) Mortality rate: specifically from malnutrition in infant and in 1-4-year age group from specific diseases (measles, weanling diarrhea) in hospital and elsewhere
b) Birth rate
c) Average birth weight of full-term children
d) Number of physicians, paramedical personnel, hospital beds and health centers per 100,000 inhabitants
e) Quality of housing (structure of house, number of persons per room etc.)
f) Quality of environmental sanitation (access to piped water, waste disposal facilities, etc.) g) Types of vaccination programs

In choosing socioeconomic factors, it is necessary to consult experts in this specialty so that suitable indices can be selected similar to those used successfully for evaluation of national development. Indeed, the research methods and techniques used by social development experts might have some validity to studies on problems of malnutrition.

3 NUTRITION REHABILITATION CENTERS

Nutrition rehabilitation centers, which are known in some countries as "mothercraft centers" or nutrition education and rehabilitation services (NERS), are directed at improving the nutritional status of malnourished children in the community and at educating parents in preventing malnutrition in the family. They must, however, not be confused with centers operating under the aegis of social welfare agencies, also known as mothercraft centers in many countries, which may educate mothers generally in housecraft and child care but do not deal with the feeding and rehabilitation of malnourished children.

3.1 Activities

Two main types of rehabilitation centers exist, the domiciliary type, often attached to a hospital, and the day-care type center. In both instances the children are fed nutritious local diets prepared, under suitable instruction, by the mothers. It has often been found that mass distribution of food commodities to families does not necessarily affect the nutrition of the target group. For this reason, the use of rehabilitation centers may prove more effective. However, perspective is required when using these centers; they are not a panacea for childhood malnutrition in the community.

The emphasis given them will differ within countries and with the local community pattern of malnutrition. In some countries, in addition to nutrition rehabilitation centers, other types of nutrition services have been established, such as food demonstration units, nutrition centers and feeding units for preschool children. These are utilized for nutrition education of mothers and for provision of food supplements to young children.

Some economic and social indicators

a) GNP per capita and other economic and social data
b) Socioeconomic distribution
c) Daily caloric intake, percentage of protein/calories
d) Family status (percentage of working family members, amount of cultivable land per family, etc.)
e) Agricultural production per male agricultural worker
f) Primary school attendance rate

3.2 Evaluation

The nutrition rehabilitation centers have been found useful in times of emergency (Biafra, East Pakistan refugees in India) and when the point prevalence of malnutrition in a community is high (Haiti). Although there is a need for careful evaluation of their cost and replicability in a given community, they are in fact cheaper than the hospitalization of the malnourished child and reduce the cost of the convalescence period (US $7 to 15 a day in a pediatric hospital bed to US $0.40 to 0.70 per child in the nutrition rehabilitation centers). However, different inexpensive methods must be devised to deal with malnutrition in different ecologies. Apart from their primary function, these centers are also an excellent educational tool at many levels. They are useful in persuading and convincing the medical establishment and classical nutritionists of the effectiveness of simple approaches to treating and preventing first- and second-degree malnutrition in preschool children. They are often of great help in diminishing the pressure on scarce hospital beds and achieving the needed nutritional rehabilitation at a reduced cost. They are also excellent centers for training physicians, nurses and para-medical personnel working in the field. They will awaken in the community at large an awareness of the existence of malnutrition in their midst and its causes and encourage community participation in the solution of the problem.

Nutrition rehabilitation centers are a useful component of a general network of services, which are all aimed at preventing and treating malnutrition in the vulnerable preschool child group.

4 PRESCHOOL CHILD FOOD CONSUMPTION SURVEY

In preschool children the prevalence of malnutrition is higher than in any other age group. It would, therefore, be of special interest to obtain data on food consumption in this age group. Unfortunately the collection of reliable data of this kind meets with great difficulties. Several factors contribute to this state of affairs. During the first year of life, and often also during the second and third year, a majority of children in developing countries still receive breast milk. The quantity of this, however, varies widely and can be determined only with considerable difficulty. Furthermore, children of this age group may already participate in eating from the communal dish. Many children are also nibbling outside the home in a way which does not easily lend itself to correct determination of consumption.

Different approaches have been used by different workers to study the food consumption of the preschool child and these and the problems inherent in such studies have been briefly reviewed in the earlier report of the ad hoc Group on Feeding the Preschool Child.

Some new avenues of study have recently been tried (3), which aim at breaking down data from total food consumption of households to the food consumption of separate age groups. With these techniques a much larger number of households can be studied without increasing the number of qualified staff as compared with studies using recording methods. Data obtained by the Lederman method have been presented in the FAO Nutrition Newsletter (4). This same method is now being used for the analysis of household studies in Rome. The results obtained seem to suggest that for reasonable accuracy the minimum sample needed is of the order of 300 households. The validity of the method when used in developing countries is now being tested in Peru, with appropriate adjustments, on a survey sample of 8,500 households. The results are expected to be available in 1973.

It is a fact that all methods used so far for food consumption studies in preschool children are afflicted with severe shortcomings. It seems reasonable to take the stand therefore that too elaborate studies involving large staff and funds should not be recommended. For many purposes, especially in studies on the epidemiology of malnutrition, a study of the general dietary pattern, combined with a study of the 24-hour recall type of food intake in comparatively large (50-200) groups of households, as well as a study recorded over 3-7 days in a limited number (15-20) of households and at different seasons may prove adequate.

Data from food consumption surveys of different age groups, including preschool children, are of considerable value for development of applied programs and economical evaluations such as cost-benefit and cost-effectiveness and also for educational purposes. The ad hoc Group recommends that the various methods available be evaluated and that based on this information a guideline on the methodology of preschool child food consumption surveys be prepared. The ad hoc Group recommended the appointment of two short-term consultants, one a nutritionist and the other a statistician, to undertake this task. The draft document prepared by the consultants may be made available for discussion at the next meeting of the PAG ad hoc Group.

5 WATER REQUIREMENTS OF INFANTS AND CHILDREN IN TROPICAL COUNTRIES

In spite of several reports on water requirements in dehydrated infants and children, the literature on this subject in normal and malnourished infants, especially those living in hot tropical climates, is scanty.

The infant during his first year of life is at a disadvantage as regards his water and electrolyte requirements. This is largely related to the greater water content and turnover rate, the increased metabolic demands for growth and the immaturity of renal function.

The malnourished child even after the age of one year suffers from similar handicaps as regards water and electrolyte regulation. The infant and the malnourished child are thus specially vulnerable to the effects of dietetic, climatic, pathological and other variables affecting water regulation.

5.1 Water requirements of the normal infant

For the normal infant living under constant environmental climatic factors, it is the type of diet which greatly influences water requirements. The *ad hoc* Group feels it is generally unnecessary to supply additional water for the adequately breast-fed infant below six months of age, thus minimizing the risk of diarrheal disease. By virtue of its lower protein and electrolyte content, breast milk supplies a very low osmotic load to the kidney. Furthermore, breast milk is automatically regulated by the infant's demands. However, in very hot, dry climates as well as in the first days of life, a water supplement may be necessary. In the absence of a safe water supply, the *ad hoc* Group recommends the use of traditional boiled herb teas provided that the herbs used are nontoxic. In all cases, the supplementary fluid should be given not by the bottle but with a spoon or similar utensil. The use of fruit juices to supply vitamin C to the breast-fed infant is not necessary (5).

For the artificially-fed infant receiving animal milk, the safety limit as regards water requirements is much less than the breast-fed infant. This is especially so if a semisolid food is introduced early. In the artificially-fed infant, the water requirements (usually recommended as 150ml/100 calories) should be appropriately modified according to the diet and environmental conditions.

After the age of six months, the introduction of semisolid foods, often rich in protein, calories and electrolytes, make a water supplement necessary. This is usually reflected in the infant's thirst. Precautions should be taken to ensure the hygienic condition of the water.

5.2 The malnourished child

The water balance of the malnourished child is greatly disturbed. As a result of the disturbance in water regulating abilities secondary to protein-calorie malnutrition, the malnourished child usually suffers from polyuria with secretion of urine of low specific gravity together with tissue overhydration. Most malnourished children live in tropical or subtropical countries with hot climates. The necessity of administering a high protein diet to these children under such hazardous environmental conditions increases the renal solute load. The _ad hoc_ Group feels that existing studies on water requirements of the malnourished child are insufficient and recommends that better controlled studies be undertaken on this subject under various environmental and dietetic conditions.

5.3 The dehydrated child

Dehydration, secondary to diarrhea in the normal infant, is reflected in the form of high blood sodium. The clinical signs are easily observed and rehydration measures for such infants can be adequately established. The malnourished child is more liable to develop gastrointestinal infections with diarrhea and vomiting than the normal infant and the usual signs of dehydration may be lacking. Dehydration is usually reflected in the form of low blood sodium with minimal dryness of the tongue or mucous membranes. Because of the wasting and/or edema, the value of skin turgor as a diagnostic aid is minimized. Episodes of simple diarrhea if not adequately managed may lead to serious fluid and electrolyte imbalance. The _ad hoc_ Group feels that a simple and early treatment of these diarrheal episodes can be effectively carried out outside the general hospital and even at home to prevent serious water or electrolyte imbalance. This early treatment entails the administration of water and electrolytes in suitable form and quantity. Such a preventive approach can be effective only if, at the same time, health education is given to mothers and if they receive advice on hygiene and child feeding in order to diminish the incidence of diarrhea and severe dehydration.

The _ad hoc_ Group recommends that data on fluid and electrolyte requirements be included in all publications dealing with the infant's basic requirements. More research work is required to determine the fluid and electrolyte requirements of the normal infant living under hazardous tropical conditions as well as of the malnourished child. Research work should also be encouraged in various regions to determine the form and composition of the most suitable simplified water and electrolyte solution to be administered for the early treatment of mild cases of diarrhea in the malnourished infant.

6 ACIDIFIED AND FERMENTED MILK IN FEEDING INFANTS AND CHILDREN

The ad hoc Group considered the available experience in the preparation and use of various types of acidified and fermented milks, with particular reference to the half-skimmed and whole-milk types, which are acidified either biologically or by addition of acid (usually lactic acid). It was noted that both liquid and dehydrated forms of the different types are available.

6.1 Usage

Acidified milk has been used with apparent benefit in the past in the U.S.A. in regions where hygienic conditions were poor and in many parts of continental Europe. The biologically fermented types in liquid form are extensively used at present in the U.S.S.R. and many other countries. Its use seems to have declined in certain countries (e.g. Sweden), but the fermented type (biologically-acidified) is still extensively consumed in powdered from in many parts of the world, mainly in Latin America. It seems clear that young infants whether well-nourished or malnourished have been fed successfully in large areas of the world on various acid milk preparations.

6.2 Stated benefits

While some of the arguments presented in the past in its favor should be reexamined in the light of new concepts and knowledge, clinical evidence and experience suggest that acidified milk may be useful because, besides its nutritional value, it offers good keeping qualities, good tolerance and the possibility of protection against alimentary infection and diarrheal disease.

Moreover, it presents some advantages from the cultural standpoint. It is a formula that may reach the target when it is distributed to mothers in health centers, and will be used in the home by the infant and not by adults as their acceptability is poor. Because of its flavor, which is less likely to be competitive with human milk, there is no danger of the formula replacing breast milk for the healthy infant.

On the other hand, it was noted that in some regions of the world the children do not like the taste and in others the parents discourage children from consuming the product in the belief that it is harmful.

Care should be taken when feeding it to premature infants who might seem inclined to acidosis. On the basis of available evidence, it appears acidosis is a problem when D (-) lactic acid is used and not when L (+) lactic acid is used or biological acidification is carried out.

The ad hoc Group felt that some claims of the beneficial effects of acidified milk deserved further investigation, making full use of the more advanced techniques in the microbiological, biochemical, pediatric and other medical fields and statistical methods in the interpretation of the results.

7 EVALUATION OF SUPPLEMENTARY FEEDING PROGRAMS FOR PRESCHOOL CHILDREN

Despite the operation of large-scale feeding programs in many countries for a number of years, there has been little or no objective evaluation. Opinions expressed by individuals or organizations are based mainly on impressions. The continuing massive problem of malnutrition in young children and the limited resources committed so far make evaluation of feeding programs and comparison with alternative interventions imperative. In spite of their importance, there are no publications offering guidelines on the evaluation of child feeding programs. The report of the Joint FAO/WHO Technical Meeting on Methods of Planning and Evaluation in Applied Nutrition Programmes (6) contains suggestions and conclusions on planning and evaluation relating to applied nutrition programs receiving assistance from international agencies. The Protein Advisory Group is at present preparing a guideline for evaluation of nutrition action programs.

7.1 Definitions

To enable evaluation of a project or program the ultimate objective (or goals) of the program must be clearly defined. The objective may be, for example, reduction of morbidity and/or mortality of preschool children or promotion of optimal physical, mental and behavioral development, or it could be something less directly related to child feeding per se, such as incentive for mothers to attend MCH and family planning centers. Indicators should then be identified; that is, the measurable indices of progress towards reaching objectives.

In a feeding program, it is often observed that there are one or more beneficial steps (intermediate objectives) which lead to the achievement of the ultimate objective. For example, the intermediate objective might be to reduce PCM in order to reduce morbidity and mortality, or it might be to attract more parents and children to centers in order to receive health or family planning advice and services. Appropriate indicators, if selected, will help to determine whether the intermediate objectives are being achieved. Examples of indicators are changes in numbers of hospital admissions for treatment of PCM, changes in height, weight and arm circumference, attendance at health services or educational centers, etc.

It is essential to have appropriate baseline information on the problem, resources and infrastructure in order to conduct the evaluation. All of the resources assigned to a program (inputs) must be taken into account, including items sometimes overlooked, such as personnel, either part-time or full-time, transport, buildings, etc.

There can be various kinds of evaluation, including measures of effort, results, activities, methods and techniques, administration and cost effectiveness.

The primary output, i.e. the direct and primary intended consequences of a feeding program, generally will be the improvement of children's diets. While it is conceivable that certain objectives could be attained without the actual consumption of supplementary foods by the children for whom they are distributed, it will usually be important to know to what extent such consumption actually occurs.

There are many types of feeding programs. They may deal with a short-term emergency; they may be relatively short-term "holding actions", while other measures are taken to achieve the same goals; or the intent may be to establish a feeding program as a permanent institution. The purpose of the program may be the alleviation of PCM, prevention of PCM, or something else. The program may operate continuously or only at times of the year when there is a special need. There is variation in the foods distributed and distribution and feeding channels, e.g. institution vs. the home. The type and degree of sponsorship, participation and support by official agencies, voluntary organizations, communities and families will vary. Compilation of the various characteristics will give a "program profile" and will serve to identify the type of program being evaluated. This is important since programs vary greatly and the results of one evaluation may not be relevant to a very different type of program as defined by its "profile". It would be desirable to evaluate a number of representative programs which combine the most common characteristics, and if feasible, other programs which incorporate innovative features.

To the extent that feeding programs are considered to be within the context of MCH services, evaluation should be on that basis.

7.2 Evaluation

The Protein Advisory Group of the United Nations System recommends preclinical testing of all new supplementary foods based either on new ingredients or new processing techniques (PAG Guideline No. 6) and subsequently clinical testing (PAG Guideline No. 7) for acceptability, tolerance and nutritional value using appropriate human subjects. Once the food passes these tests it may be used for supplementary feeding with reasonable confidence provided the mixture is adapted to local dietary patterns. It has been difficult to show effects on height and weight, for example, under real-life conditions. It should be borne in mind that even if the results according to these indicators are negative, there may be positive effects on well-being, as for example through increased physical activity of the child, which indeed may be interrelated with increased adult-child interaction and a resulting improvement in mental and behavioral development. There may also be decreased morbidity due to amelioration of the malnutrition/infectious disease complex.

Evaluation, especially if it involves careful food consumption studies, may be relatively expensive. It may not be feasible to apply the same methods to pilot projects and to national programs; for the former relatively greater emphasis should be given to effectiveness as actually measured by results obtained; while for larger subsequent programs more emphasis should be placed on efficiency of operations, degree of community participation, etc.

Ideally, provision for evaluation should be a part of the planning and implementation process, and both the planning and evaluation of feeding programs should take many factors into account, including dietary needs, perspectives for local food production and processing, the relative need for nutrition education, environmental sanitation and control of infectious diseases, etc. A period of at least several years may be needed for adequate evaluation. It must be kept in mind that various socioeconomic and public health factors may be changing in a community at the same time a feeding program is operating. The very inception of a feeding program may promote some of these changes. In any case the changes might eventually modify or even eliminate a need which the feeding program was designed to meet.

In addition to evaluations conducted by the staff operating the programs, there should be periodic evaluation by impartial independent teams from outside who are not involved in the operation of the project.

The effect of supplementary feeding on the efficiency of preschool education, both nonformal and formal, as preparation for primary school and later education and entry into the labor resource would be of special interest to development planners.

It would be desirable to agree on an international basis to standard definitions and terms to facilitate evaluation of programs including those with involvement and support of a number of sources, i.e. international, bilateral, private, foundation, voluntary agency, etc. It is recommended that the PAG develop specific guidelines for the evaluation of preschool feeding programs and also develop guidelines for planning and evaluation of preschool nutrition projects in general.

8 LIST OF TOPICS FOR FUTURE DISCUSSION AND RECOMMENDATIONS FOR FURTHER RESEARCH

8.1 Proposals for items to be discussed at future Working Group meetings

The *ad hoc* Group considered the following list of subjects important and recommended to the PAG that these items be accepted for discussions at future Working Group meetings. Regarding item (d)i, it was noted that the Sponsoring Agencies had earlier agreed to hold a working group meeting to consider this subject.

a) Legislation concerning the protection of pregnant and nursing women. A review of the historical aspects on legislation in this field will be useful and it was suggested that a suitable background document may be prepared for use in the discussion.

b) Nutrition and family planning, including interaction of lactation and contraception. The *ad hoc* Group was informed that FAO, WHO and UNICEF have several activities and programs in this area.

c) Review of the current status and developments concerning low-cost protein-rich foods (domestic and/or imported). It was noted that some of the comments on the limited success of low-cost protein-rich foods are based on outmoded information obtained in earlier stages of their introduction and it is time for PAG to obtain and project a correct picture. The Group recommended that the PAG accept this as a subject for discussion at the 20th session so that suitable status papers on products on sale and those being developed could be evaluated from all angles.

d) Guidelines concerning legislation, labeling and advertising of foods for infants and young children. i) Discussions with representatives for dietetic foods of the Codex Alimentarius Commission. ii) Roundtable discussions between infant-food industry representatives and pediatricians. In this dialogue, the inclusion of some food advertisers and mass media people will be useful.

e) Preschool food consumption surveys, the need for preparation of a guideline. (See recommendation on page 11).

f) The role of legumes in feeding of infants and young children. This was considered to be an important subject with special interest concerning the amount of legumes which can be fed safely and at the same time be acceptable to young children. For these reasons, it was recommended that it be included in the agenda of a future PAG meeting.

g) The role of edible green leafy vegetables in infant feeding.

h) Planning, development and evaluation of preschool nutrition programs.

i) Experience with newer anthropometric measurements.

8.2 International meetings of relevance to the work of the ad hoc Working Group

a) Families and children "at-risk" in developing countries (a meeting which is planned by IUNS for 1973).

b) Early malnutrition and mental development (a workshop proposed to be arranged by WHO in cooperation with the Swedish Nutrition Foundation in 1973).

c) Meeting between chief executives of leading baby-food industries and pediatricians/nutritionists (to be sponsored by FAO, WHO and UNICEF).

8.3 Research proposals

a) A coordinated international study on the sociocultural dynamics of breast feeding.

b) A coordinated international study on the effects of urbanization on the nutritional status of the child.

c) Water and electrolyte requirements of infants of different ages under extreme heat and/or humidity.

d) Reaction of children with PCM to severe dehydration.

e) Systematic studies on problems pertaining to use of acid milk (fermented or otherwise acidified), e.g. bacterial growth, keeping quality, effect on intestinal microorganisms, protection against diarrheal disease, etc.

f) Comparative study of child mortality in different social classes.

g) Weight gain in pregnancy as an "at-risk" indicator.

h) Models for comprehensive MCH services.

i) Formulation and testing of emergency foods for infants and young children.

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Appendix I

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Appendix II

AGENDA*

1. Opening of meeting and introductory remarks.
2. Adoption of agenda.
3. Causes of infant and childhood mortality - methodology of measurement and nutritional and health implications.
4. Criteria for identification of mothers and preschool children at risk of developing malnutrition.
5. Preschool child food consumption surveys.
6. Water requirements of infants.
7. Acidified and fermented milk in feeding infants and children.
8. Guideline for evaluation of supplementary feeding programs for preschool children.
9. Other business.
10. Formulation and adoption of report.

*At the suggestion of Professor N.S. Scrimshaw at the meeting, the _ad hoc_ Group briefly discussed the topic "Nutrition Rehabilitation Centers". The report based on this discussion is included in this report.

Appendix III

LIST OF BACKGROUND DOCUMENTS

1. Nutritional significance of mortality statistics by J.M. Bengoa (paper presented at Western Hemisphere Nutrition Congress III, 30 August - 2 September 1971).

2. (a) Interamerican Investigation of Mortality in Childhood - Drs. Ruth R. Puffer and Carlos V. Serrano, Health Statistics, PAHO (Document 1.14/23); and (b) Utilization of the Results of the Investigation in Nutrition Programmes - Dr. Roberto Rueda-Williamson (Document 1.14/24).

3. The at-risk concept and young child nutrition programmes (Principles and practice) by D.B. Jelliffe and E.F.P. Jelliffe (Document 1.14/18).

4. Medical, socioeconomic and public health indicators of the risk of malnutrition in mothers and children by P. Satgé (Document 1.14/22).

5. Water requirements of the young child by P. Satgé. (Document 1.14/21).

6. Water requirements of infants by M. Gabr (Document 1.14/17).

7. Scientific rationale for the use of acidified and fermented milks in feeding infants and young children by M. Gabr (Document (1.14/16).

8. Scientific rationale for the use of acidified and fermented milks in feeding infants and young children by O. Ballarin (Document 1.14/19).

9. Scientific rationale for the use of fermented milk in infant feeding by V.K. Tatochenko (Document 1.14/20).

10. Guideline for evaluation of nutritional supplementary programs for preschool children by M. Forman (Document 1.14/25).

Summary

PAG *AD HOC* WORKING GROUP ON MILK INTOLERANCE - NUTRITIONAL IMPLICATIONS

The PAG *ad hoc* Working Group met at the headquarters of the Pan American Health Organization, Washington, D.C., U.S.A., on 29 and 30 October 1971. The members of the Group present were: Professor Bo Vahlquist (Chairman), Sweden; Dr. R. Luyken, The Netherlands; Professor M.C. Latham, U.S.A.; Professor G.G. Graham, U.S.A.; Dr. V. Reddy, India; and Professor O. Ransome-Kuti, Nigeria. Dr. O. Ballarin, Brazil; Professor M. Gabr, Egypt; and Professor P. Satgé, France, attended the meeting as guests. The following representatives of the Agencies participated: FAO, Dr. G.D. Kapsiotis; WHO, Dr. J.M. Bengoa; UNICEF, Dr. L. Teply; WHO/PAHO, Drs. R. Rueda-Williamson, J.G. Chopra, B. Bosley and D.B. Jelliffe. Dr. Katherine Bain, U.S.A., and Mrs. P. Jelliffe, Jamaica, attended the meeting as observers. Professor N.S. Scrimshaw, Chairman of the PAG attended and Drs. M. Milner and P.S. Venkatachalam represented the PAG Secretariat.

The *ad hoc* Group reviewed the work undertaken in various parts of the world on the problem of low lactase activity of primary origin and its practical implications on milk usage in developing countries.

Clinical conditions exhibiting low lactase activity

The *ad hoc* Group considered congenital lactase deficiency and low lactase activity due to other factors and noted that the former is a rare condition due to an hereditary disorder and the latter, associated with very many disease states, is a frequent cause of unexplained diarrhea among infants and young children in developing areas of the world. It was emphasized that unless information regarding lactase activity in a healty state prior to the illness is available, it is generally difficult to know in non-Caucasians whether the low lactase activity is due to a primary absence of the enzyme or is secondary to the observed illness.

Primary low lactase activity and milk intolerance

The four terms commonly used in the literature were defined (see definitions on p. 9 under PAG Statement No. 17 on Low Lactase Activity and Milk Intake following this report) and the methods of diagnosis were indicated.

The manifestations of intolerance to lactose, whether due to congenital, primary or secondary low lactase activity, are similar, although in the rare congenital variety the reaction is usually more severe. When symptoms of intolerance occur, they may include one or more of the following:
1) abdominal pain, cramps and discomfort;
2) diarrhea and abnormalities in the stool; and
3) production of gas leading to bloating, flatulence, etc.

The mechanism responsible for these symptoms has not been fully investigated. However, lactose remaining in the gut lumen acts as a hydragogue, causing a net water movement from the plasma to the gut lumen. This is a result of the effective osmotic pressure of the lumenal contents containing the nonabsorbable solute being higher than that of the plasma. The accumulated water causes distention, provoking increased intestinal motility. The undigested lactose, upon reaching the colon, serves as a substrate for colonic bacteria; fermentation occurs with the production of organic acids, mainly lactic and acetic acids. These act as irritants, causing increased peristalsis and subsequent diarrhea. Bacterial degradation also results in the production of gas, mainly carbon dioxide.

Prevalence

Studies on the prevalence of lactose intolerance have been carried out in many parts of the world. The majority of the studies are confined to adult subjects and not many data exist on the prevalence of the condition in children of different age groups. A number of these studies have been conducted on small groups of subjects chosen from those hospitalized for some ailment. Also, it is not clear whether efforts were made to distinguish between primary and secondary absence of lactase. Another important limitation of most of these studies, from the practical point of view, is that they were primarily oriented toward determining the prevalence of low lactase activity using techniques such as intestinal biopsy and oral lactose load tolerance tests and relating the presence or absence of clinical signs and symptoms to the lactose load. While this information is of great value in itself and a significant contribution to the understanding of the problem, the results of these studies cannot indicate the response of a subject with primary low lactase activity to consumption of graded amounts of animal milk. Any interpretation of the results of these studies should therefore keep in mind the limitations mentioned above.

The ad hoc Group noted that the prevalence of low lactase activity, lactose malabsorption and lactose intolerance in adults is low (about 1%) in Europe. In North America, the frequency based on abnormal tolerance tests seemed to be slightly higher (6 to 19%) for the white American population, and for black Americans the corresponding values were significantly higher (72 to 77%). More studies on children of different age groups are required, particularly on black and white children in North America.

The prevalence of low lactase activity in Africa, Asia, the Middle East and in Latin America is high and the figures seemed to vary from 50 to 100% in the different studies. The two predominant points which emerge from most of these studies are: 1) a lack of relationship in individual subjects between the ingestion of milk and the results of lactose tolerance tests. The answer to this may lie in the fact that intolerance to milk consumption for each individual subject may depend on a particular quantity of milk consumed and each person has learned not to exceed his limit. 2) There is a very high incidence of low lactase activity and lactose malabsorption among the adult populations studied in Asia, Africa, the Middle East, and Latin America and the nonwhites in the U. S. A. However, not all of these people show lactose intolerance to the standard lactose load. The phenomenon appears to be less frequent among children and seems to develop progressively with age.

Clinical and nutritional implications

The ad hoc Group examined the meager information available regarding milk consumption practices in the developing areas of the world and the extensive literature available on its use in the treatment and prevention of malnutrition and particularly PCM. It was able to review the experience in the use of milk in preschool child feeding programs and school lunch programs. The Group felt that on the basis of current evidence, the quantity of milk fed in these programs will rarely lead to disturbing clinical signs and symptoms due to low lactase activity. Lactose intolerance need not pose any clinical problem insofar as protein therapy of PCM with milk is concerned in hospitals and in other institutions possessing adequate facilities.

The occurrence of low lactase activity in the majority of the adult population in developing areas of the world has made it necessary to evaluate the nutritional implications of milk consumption with special reference to the role of milk as a source of protein and other nutrients for the vulnerable groups. In individuals with clinical manifestations after milk consumption, it is probable that absorption of protein and other nutrients will be affected. However, the important nutritional concern is whether in those with no alimentary signs or symptoms and who form the large majority, milk feeding will affect the absorption of protein and other nutrients present in milk. Further research is necessary to evaluate this aspect, particularly in children fed ordinary as well as lactose-free milk in different quantities commonly used in child feeding programs. Again, there is no information on whether low lactase activity affects absorption of nutrients other than protein in milk. Nevertheless, the available data suggest that a variable quantity of the lactose of milk may be lost in the stools, implying a loss of calories from this carbohydrate source. More information is required with respect to digestion and absorption of various milk nutrients by persons with low lactase activity consuming the customary amounts of milk.

Efforts are underway in many developing countries to actively promote dairying and milk production. Large quantities of milk and milk products are also donated through international and bilateral aid programs to developing countries as support for various large-scale nutrition feeding programs. Since milk feeding is recommended primarily to offer some high-quality protein to the consumer, on the present evidence there is no basis for discouraging programs where the aim is to improve milk supplies and increase milk consumption.

The use of low lactose preparations for special situations and the production and use of low-cost protein-rich foods using proteins from vegetable sources containing small amounts of dried skim milk powder were reviewed and the priority areas for research in this field listed.

(The report of this meeting is available as PAG Document 1.27/9).

PAG STATEMENT 17 ON LOW LACTASE ACTIVITY AND MILK INTAKE

During the last few years, reports have appeared in the world medical literature on the occurrence of low intestinal lactase (exact term: β-galactosidase) activity in large groups of apparently healthy nonwhite populations in different parts of the world. Some of the reports and many articles in the lay press have concluded that milk consumption by these people may lead to untoward reactions in the form of gastro-intestinal disturbances ("milk intolerance") and may interfere with the proper utilization of milk nutrients. Doubts have been raised as to whether it is desirable to use milk as a source of supplementary food for children in the developing areas of the world and whether milk and milk products should be exported throughout the world for use in nutrition programs.

It is the considered view of the PAG based on the report of its ad hoc Working Group on Milk Intolerance that the evidence presently available does not justify the above doubts, for the following reasons.

The results obtained with standard lactose tolerance tests, the procedure most commonly used to evaluate intestinal lactase activity, cannot be used as indicators of milk intolerance. Low lactase activity, lactose intolerance and milk intolerance are not synonymous[*] although they have been used as such in many publications. An intolerance to lactose in the large amounts commonly used in load tests (50g of lactose or more per m^2 of body surface) which correspond in an adult to the consumption at one time of 1.0 - 1.5 liters of milk, gives no information on the existence of milk intolerance when the milk is consumed in moderate quantities.

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[*] Definition of terms

Low lactase activity: Less than 2 units of lactase activity per gram wet mucosa

This can be demonstrated in either of two ways:

a) directly by examination of biopsy material
b) indirectly by lactose tolerance test ("flat" blood sugar curve, i.e. rise of 25 mg % or less following ingestion of standard lactose dose: 50g/m^2 or 2g/kg in children)

Lactose malabsorption: Reduced absorption of lactose, a consequence of low lactase activity, determined by lactose tolerance test described above.

Lactose intolerance: Clinical signs (abdominal pain, diarrhea, bloating, flatulence, etc.) following ingestion of lactose, mixed in water in standard dose or less, in a person with proven lactose malabsorption.

Preschool child feeding programs and school lunch programs, which have been in operation in many developing areas of the world for well over two decades, use only about 200ml to 250ml of milk per day and in many programs this is taken with other food. This quantity of milk contains only about one-quarter of the amount of lactose used in standard load tests for these ages. Skimmed milk powder, which is used in many of these programs, contains more lactose than whole milk. Even so, consumption of reconstituted skimmed milk powder will offer a lactose load considerably below that used in lactose load tests. These load tests measure the presence of enzyme activity and not the capacity of the child to tolerate the quantity of milk which he normally consumes.

Practical experience in the field has demonstrated that some of the children who reject the regular quantity of milk during the initial stages of a program are able to accept the same amount after they are accustomed to it. In areas where the population is not accustomed to milk drinking, it might be prudent to start milk feeding programs with reduced amounts of milk, and increase the quantity gradually to the regular dose.

It has been reported from one industrialized country that a large number of nonwhite elementary school children receiving milk as part of the school lunch consumed only one-half or three-quarters of the daily quota of milk supplied. This has been stated to be the result of low lactase activity, but it remains to be proved; low milk intakes have also been found in studies of North American and European school children in whom low lactase activity was not a factor.

In all the investigations on lactase activity available so far in the literature, the total number of children included is relatively small and among these studies there are comparatively few systematic surveys on prevalence. Reasonably-sized groups have been investigated for lactase activity mainly in Northern Europe and the number involving children in different age groups is very limited. The information available regarding prevalence in populations in Asia, Africa and Latin America is much less and only recently have adequate attempts been made to include children from such groups as subjects for investigation.

There is a great need to undertake further prevalence studies among children of various ages in nonwhite populations, using standard and comparable procedures, before the extent and magnitude of the problem of low lactase activity, the age at which the fall in activity occurs in various populations and the implications of the findings for milk consumption by children can be assessed.

Milk is considered a virtually complete food and in the developing areas of the world, where protein deficiency is widespread and protein-calorie malnutrition a serious childhood problem, the use of milk for child feeding programs is strongly advocated by all nutrition experts. The PAG wishes, however, to emphasize that there are several areas where our knowledge is deficient or lacking on this complex subject and steps should be taken to close the gaps. Physicians in developing countries and authorities supervising milk feeding programs should also be made aware of current knowledge on this subject and its implications.

It would be highly inappropriate, on the basis of present evidence, to discourage programs to improve milk supplies and increase milk consumption among children because of the fear of milk intolerance.

Milk intolerance due to lactose content: Clinical singns (abdominal pain, diarrhea, bloating, flatulence, etc.) consistently following a few hours after ingestion of milk or milk-containing products in usual amounts in a person with proven lactose malabsorption.

PROTEIN ADVISORY GROUP OF THE UNITED NATIONS SYSTEM

Protein Advisory Group
of the
United Nations System

17 January 1972

Milk Intolerance -
Nutritional Implications
Document 1.27/9

REPORT ON THE PAG AD HOC WORKING GROUP MEETING ON MILK INTOLERANCE - NUTRITIONAL IMPLICATIONS

WASHINGTON, D.C., U.S.A., 29-30 OCTOBER 1971

1. INTRODUCTION

During the last few years, reports have appeared in the world medical literature on the occurrence of low intestinal lactase activity and lactose intolerance in large groups of apparently healthy populations in different parts of the world. In these individuals with low lactase activity in the intestinal mucosa, administration of an oral load of lactose (about 50g) has been reported to bring about a low blood glucose response (flat glucose curve) and many among them are also reported to exhibit untoward reactions in the form of moderate to severe gastrointestinal disturbances. It was also shown in some studies that milk and milk products, a rich source of lactose, when consumed in large quantities at one time induced clinical symptoms of intolerance.

1.1 Low lactase activity

The terms lactose intolerance and milk intolerance (i.e. intolerance of a subject to lactose in milk) are frequently referred to in the literature as "lactase deficiency". The term lactase deficiency for a condition that probably exists in the majority of the world's adult population and in nearly all mammalian species is perhaps a misuse of the term. The term "lactase deficiency" is probably best not used for this condition and might be replaced instead by the term low lactase activity.

1.2 Lactase activity in man and animals

In most mammals the highest lactase activity is found at birth. In man intestinal lactase activity is present in the fetus from the third month of gestation with maximum secretion being reached at the end of gestation (1,2). It remains high during the period of breast feeding and falls to about one-tenth of this level following weaning (3). High levels of activity are maintained during infancy but in a large percentage of children and adults of all but the white races lactase levels are commonly low and occasionally absent. This seems to suggest that man, like most other mammals, usually has a high level of lactase activity during early life (infant pattern) to cope with the lactose consumed in breast milk but that the level may decline with age following weaning. However, most Caucasians and a few other adult populations retain the infant pattern of lactase activity during adolescence and adult life. Among the mammals, the California sea lion does not produce intestinal lactase at any time nor does the milk of the female sea lion contain lactose.

1.3 Persistence of infant pattern of lactase activity

Theories to explain geographic, ethnic and racial differences observed include a genetic theory and an "adaptation" or "acquired" theory, or occasionally a mixture of genetic and acquired, sometimes called genetic adaptation. If the infantile pattern of lactase activity in adults is genetic in origin it should occur regardless of continued milk intake after weaning. In contrast, if adult lactase activity is an adaptive or acquired phenomenon then it would be found only if there is a continued substrate challenge in the form of milk consumption over a long time.

The research to date is inconclusive, but the main epidemiological and research evidence suggests a genetic basis for differences of lactase activity in adults. In general, attempts in animals and man to induce higher levels of lactase production by challenge with lactose or milk have not been successful so far. Admittedly, though, the periods of challenge used in these studies have not been very long. The more important question relating to adaptation, from a practical point of view, is whether those with low levels of lactase activity, particularly young children, will adapt so that they will tolerate milk consumption even if their levels of lactase activity are low. Although more research is needed, the evidence suggests that adults and children do adapt in this way.

The rationale for this development of a tolerance or adaptation to milk is unknown. It may be due to the fact that small quantities of lactase are dealing satisfactorily with the lactose ingested without causing a normal rise in blood sugar, or it may be due to the development of a tolerance to unabsorbed lactose and the products of its breakdown. Although more research is needed on the practical problem, it seems that both children who get clinical symptoms and those who fail to get the expected blood sugar rise following a standard lactose load, can either immediately or after a period of time consume milk at levels normally provided in nutrition programmes without any difficulty. Clearly the type and amount of milk, whether it is consumed with other foods, its dilution and its lactose content are all factors which might determine whether or not untoward symptoms develop.

1.4 Clinical conditions exhibiting low lactase activity

1.4.1 Congenital lactase deficiency with no lactase activity. This clinical condition, first described by Holzel et al. (4), is due to the absence of intestinal lactase at birth, the defect lasting throughout life. Diarrhea is the main symptom, beginning within the first few days or weeks of life, as soon as milk feeding has been well established. Severe vomiting and cramping may also occur. The intestinal mucosa remains normal. If the diarrhea persists, with its concomitant loss of fluid, electrolytes and lactose (which may comprise 50 per cent of the total caloric content of the milk), malnutrition and growth failure will occur. If a lactose-free diet is not initiated, the infant may fail to thrive or even die. When milk is removed from the diet and replaced by other suitable foods the symptoms subside and weight gain begins again.

The condition, believed to be hereditary, is uncommon and relatively few cases have been described in the literature (5). Congenital lactase deficiency should not be confused with mild degrees of lactase deficiency regularly found in premature infants.

1.4.2 Low lactase activity of secondary origin. A reduced level of intestinal lactase activity is frequently found secondary to mucosal damage, associated with other disease states (6-13). Lactase is located in the brush border of the villi and so any damage to the microvilli results in depression of disaccharidase activity, particularly lactase activity (14). Many gastrointestinal diseases prevalent in tropical and nontropical countries affect this enzyme activity. Of particular concern in infants and young children in developing countries is diarrhea due to gastroenteritis and other causes and protein-calorie malnutrition, both of which are extremely prevalent and both of which often lead to abnormal morphology of the intestinal villi (15). It has been pointed out that many people of all races and age groups living in unsanitary and poor hygienic conditions in tropical countries have this abnormality.

When the cause of the mucosal damage subsides or responds to treatment, the enzyme activity usually improves. Sucrase and maltase are quick to reach their normal levels, while lactase activity responds more slowly. In fact lactase levels may remain abnormally low for several years after the other disaccharidases have returned to normal (16, 17). Unless lactase activity is determined by biopsy or lactose intolerance tests performed prior to the illness it is generally difficult to know in non-Caucasians whether the low lactase activity is due to a primary absence of the enzyme or is secondary to the observed illness.

1.4.3 Low lactase activity of primary origin. A condition now known to occur on a worldwide basis, with low lactase activity and lactose intolerance affecting different racial groups, was first described in 1963 by Auricchio et al. (18) and by Dahlqvist and Thomson (19). Lactase activity is normal during infancy and early childhood but later on declines during childhood and early adulthood. Study of the enzymes of intestinal biopsy specimens show a depression of lactase activity (possibly 10 per cent of normal levels, rarely absence of lactase activity) in an otherwise morphologically normal mucosa. By definition low lactase activity of primary origin is neither congenital nor secondary to mucosal damage. The ad hoc Group considered at great length the problem of primary low lactase activity and reviewed its significance to the occurrence of milk intolerance. The discussions on this subject are presented in Section 2.

1.5 Milk intolerance from causes unrelated to lactose

In addition to the above, milk intolerance can result from several other causes unrelated to the lactose content of milk. Intolerance to other normal constitutents of cow's milk (or that of related species), namely to one or more of its protein constituents, in the form of allergy or blood-protein-losing enteropathies can occur in individuals occasionally with either overt or insidious manifestations. Although a discussion of these syndromes was outside the scope of the meeting, the ad hoc Group felt that the development of milk intolerance in the form of blood and protein loss through the gut in children receiving undenatured cow's milk protein should be brought to the attention of the PAG in view of its potential public health significance. Wilson et al. (20) demonstrated that approximately 50% of infants seen by them with typical iron deficiency anemia were chronically losing a significant amount of blood into their gut daily and that this blood loss stopped promptly when their intake of undenatured cow's milk protein from pasteurised milk was significantly curtailed. It has since been demonstrated that bovine serum albumin is almost certainly responsible for this phenomenon and that it also causes loss of plasma proteins into the gastrointestinal tract, particularly of albumin, thus leading at times to severe hypoalbuminemia in addition to anemia.

When milk protein is denatured by heating, the phenomenon is no longer observed. It is not clear at this time whether all spraydrying processes equally bring about milk protein denaturation and how consistently so. Obviously the type of processing applied to the milk will affect the extent of denaturation of the protein. The ad hoc Group noted that this problem may be of significance in groups drinking excessive quantities of milk. Information is also required from milk processors on the nature of milk protein present in the various forms of commercially processed milk.

2. PRIMARY LOW LACTASE ACTIVITY AND MILK INTOLERANCE

A concern of the ad hoc Group was to review the world literature on the problem of low lactase activity of primary origin giving rise to lactose malabsorption and intolerance following the administration of a standard oral lactose load test and to assess its practical implications on milk usage in developing countries. Since the condition occurs at any time between the age of weaning and adulthood, in what apparently is the majority of human beings, it was necessary to examine all evidence to determine the clinical and nutritional implications of milk consumption in quantities to which the population is accustomed.

2.1 Definitions and diagnostic criteria

The four terms commonly used and their definitions are given below:

a) Low lactase activity: Less than 2 units of lactase activity per g wet mucosa

This can be demonstrated in either of two ways:

i) directly by examination of biopsy material
ii) indirectly by lactose tolerance test ("flat" blood sugar curve, i.e. rise of 25 mg% or less following ingestion of standard lactose dose: 50g/m^2 or 2g/kg in children)

b) Lactose malabsorption: Reduced absorption of lactose, a consequence of low lactase activity, determined by lactose tolerance test described above.

c) Lactose intolerance: Clinical signs (abdominal pain, diarrhea, bloating, flatulence, etc.) following ingestion of lactose mixed in water in standard dose or less in a person with proven lactose malabsorption.

d) Milk intolerance due to lactose content: Clinical signs (abdominal pain, diarrhea, bloating, flatulence, etc.) consistently following 3 or 4 hours after ingestion of milk or milk-containing products in usual amounts in a person with proven lactose malabsorption.

A definitive diagnosis of primary low lactase activity depends on the actual measurement of enzyme activity in a satisfactory specimen obtained by biopsy. This is obviously not a field tool and because of its relative difficulty and potential hazards should be used only by highly qualified clinicians or researchers. Lactose loading and the measurement of blood glucose, carried out under specific conditions, can be used to make a fairly accurate diagnosis of low lactase activity. A blood glucose rise of 25 mg/100 ml or less after an oral lactose load of 50g in adults or 2g/kg body weight in children (or better still 50g/m^2 body surface area) is almost always indicative of a lactase activity below 2 units/g wet weight of intestinal mucosa (21,22). Nearly all individuals with low activity will have their maximum blood glucose elevation over the fasting level within 60 minutes following ingestion of the lactose. In most cases this is apparent in the 30-minute sample but in many cases, if an earlier blood sample is not obtained, the elevation will be missed and a false diagnosis of a "flat" curve made (23). For this reason, obtaining samples at 0, 15, 30 and 60 minutes will identify the vast majority of "normals" with infantile-type lactase activity. If it is desirable to further reduce the number of blood samples, these might be obtained at 0, 20 and 45 minutes; further experience with this sequence is desirable before it can be generally recommended. A blood glucose elevation of 25mg/100ml or less is called "flat" and is considered indicative of lactose malabsorption. If coupled with symptoms, particularly diarrhea during the first three or four hours after loading, one might speak of lactose intolerance. Intolerance resulting from milk consumption, also called primary milk (lactose) intolerance could be said to exist if an individual, on drinking milk or milk products in usual amounts consistently develops within 3 or 4 hours gastrointestinal symptoms which disappear when milk is withdrawn and the same subject shows, on administration of a standard oral lactose load, a flat glucose curve. Neither lactose malabsorption or intolerance, determined with loads more than two or three times the maximum amount likely to be consumed in practice is proof of milk intolerance, although they have been reported to be highly correlated with low milk consumption.

2.2 Clinical signs and symptoms of lactose intolerance

The signs and symptoms of intolerance to lactose, whether due to congenital, primary or secondary low lactase activity, are similar although in the rare congenital variety the reaction is usually more severe, but individuals may respond somewhat differently. When symptoms of intolerance occur, they may include one or more of the following: 1) abdominal pain, cramps and discomfort; 2) diarrhea and abnormalities in the stool; 3) production of gas leading to bloating, flatulence, etc.

The mechanism for the production of these symptoms has not been fully investigated. However, lactose remaining in the gut lumen acts as a hydragogue, causing a net water movement from the plasma to the gut lumen. This is a result of the effective osmotic pressure of the luminal contents containing the nonabsorbable solute being higher than that of the plasma (24). The accumulated water causes distension, provoking increased intestinal mobility. The undigested lactose, upon reaching the colon, serves as a substrate for colonic bacteria. Fermentation occurs with the production of organic acids, mainly lactic and acetic. These acids act as irritants causing increased peristalsis and subsequent diarrhea. Bacterial degradation also results in the production of gas, mainly carbon dioxide.

2.3 Prevalence

Studies on the prevalence of lactose intolerance have been carried out in many parts of the world. The majority of the studies are confined to adult subjects and there is not much data on the prevalence of the condition in children of different age groups. A number of these studies have been conducted on small groups of subjects chosen from those in a hospital or admitted to an institution for some ailment. Also, it is not clear whether efforts were made to distinguish between primary and secondary absence of lactase. Another important limitation of most of these studies, from the practical point of view, is that they were primarily oriented toward determining the prevalence of low lactase activity using techniques such as intestinal biopsy and oral lactose load tolerance tests and relating the presence or absence of clinical signs and symptoms to the lactose load. While this information is of great value in itself and a significant contribution to the understanding of the problem, the results of these studies cannot indicate the response of a subject with primary low lactase activity to consumption of graded amounts of animal milk. Any interpretation of the results of these studies should therefore keep in mind the limitations mentioned above.

2.3.1 In Europe. Reviewing the results of studies (18) carried out in Denmark (25), Finalnd (26), Sweden (27), Switzerland (18) and England (28), on over 1300 adult subjects, the ad hoc Group noted that the prevalence of low lactase activity, lactose malabsorption and lactose intolerance in adults is low in Europe. The frequency of low lactase activity was reported to be lowest in Sweden and Denmark, with figures for Sweden showing less than 1%.

2.3.2 In North America. Although several studies have been carried out in the U.S.A., both on the white and nonwhite populations, they have been restricted to small groups, usually not exceeding 50, and many were selected from subjects attending gastroenterology clinics (29-33). In the white American population, the frequency based on abnormal tolerance tests varied between 6% and 19% and for American Negroes the corresponding values were 72% and 77%. The prevalence of low lactase activity and lactose malabsorption seemed to be high among Chinese and Thai residents in the U.S.A. and the American Indians.

In the only study on white and Negro children (21) (age 11 months to 11 years) in Baltimore, reviewed by the ad hoc Group, it was noted that lactose tolerance tests brought about clinical signs and symptoms in 7 out of 20 Negro children (35%) and in 2 out of 20 white children (10%). Three out of 7 Negro children and one of out of 2 white children gave a history of milk intolerance in the form of abdominal cramps on ingestion of more than one glass of milk. It is worth noting that the prevalence among black children is considerably less than the 72 to 77% reported for Negro adults, unlike the figures for the white population which do not show any difference between adults and children. Admittedly more studies on children of different age groups in the two ethnic groups are required to confirm this interpretation.

2.3.3 In Africa. The studies carried out in East Africa (35), South Africa (36) and Nigeria (37) have shown that the prevalence of low lactase activity and lactose intolerance is high. However, intolerance to lactose varied from one tribe to another, being highest among the Bantus who are traditionally non-milk drinkers and lowest among the Hamites who are cattle owners and live mainly on milk. Lactose malabsorption was also demonstrated in 70% of the children under the age of 18 months.

Of 31 Bantu adults from South Africa on whom lactose tolerance tests were performed, only 2 had a rise in blood glucose above 20 mg%. In this group, no one developed clinical symptoms and signs during the test. According to the authors, the reason for this might be that most of them drank milk every day, usually with tea or coffee or with porridge. Although the subjects were unable to hydrolyze lactose during a lactose tolerance test, they seemed to be able in some way to deal with an intake of some quantity of milk.

Kretchmer _et al_. (37) carried out lactose tolerance tests on three major tribal groups in Nigeria, the Yorubas living in the non-cattle-raising area of Nigeria and the Hausas and Fulanis living in the north of Nigeria where cattle-raising and the ingestion of milk and milk products are traditional. It was found that 99% of the Yorubas, after the age of 1 1/2 to 3 years failed to absorb lactose, whereas only 64% of the Hausas and Fulanis and 20% of the nomadic Fulanis showed malabsorption.

2.3.4 _In the Middle East_. Gillet _et al_. (38,39) studied lactose deficiency in various Jewish communities in Israel. These studies revealed that 2/3 of Jewish people were lactose malabsorbers. The incidence varied from one ethnic community to the other. Among the Yemenites, it was 44.4%, Sephardi (North Africans) 62.5%, Ashkenazi 79.2%, Iraquis 84.2%, Orientals 85.0%.

2.3.5 _In Asia_. Studies on prevalence carried out on Asians have shown that the incidence of low lactase activity and lactose malabsorption in Chinese, Malays, Thais and Indians is very high (40-44). In some of the studies, the incidence of lactase deficiency is reported to be 100% and lactose malabsorption nearly 80%.

The prevalence of this condition was found to be very much lower in children than in adults and the lactase activity seemed to decrease with advancing age (43). Reddy and Pershad (44) reported that children under 3 years possessed "normal" lactase activity and in children over 3 years lactose intolerance was observed in only 20 out of 54 children. All those who showed symptoms of intolerance had lactase deficiency but the converse was not found true. Moreover, in children with lactose intolerance following an oral lactose load of 2g per kg body weight no intolerance was observed when the oral dose of lactose was reduced to 1g per kg.

In a recent study from Japan (45) it was found that the appearance of lactose malabsorption in Japanese boys and girls was delayed and the "flat" tolerance curves were observed only in the higher age groups. A parallel dietary recall on nearly 8000 healthy subjects showed milk intolerance (in the form of a clinical reaction to a cup of milk) in not more than 0.6% in the age group between 6 to 8 years and 1.5% in the age group 18-20 years. It should be stressed that in Japan since World War II, milk has been used extensively in school feeding programs.

2.3.6 In Latin America. Very few studies have been carried out in Latin America. In Colombia (46) and Surinam (47) a high frequency of lactose malabsorption was found, comparable to the figures reported from Africa. Data from Peru (48) indicated that a considerable number of children by 3 to 5 years of age have lactose malabsorption.

Low lactase activity and lactose malabsorption have also been reported in Eskimos, Cypriots, New Guineans and in different oriental groups (Chinese, Japanese, Koreans and Filipinos) living in the U.S.A.

In almost all of these studies, the points that stand out clearly are: 1) a lack of relationship in individuals between the ingestion of milk and the results of lactose tolerance tests. The answer for this may lie in the fact that the expression of intolerance to milk consumption for each individual depends largely on the quantity of milk consumed and each person has learned not to exceed his limit. 2) There is a very high incidence of low lactase activity and lactose malabsorption among the adult populations studied in Asia, Africa, the Middle East and Latin America and the nonwhites in the U.S.A. Not all of these people show lactose intolerance to the standard lactose load. The phenomenon appears to be less frequent among children and seems to develop progressively with age. Also, there appears to be a difference in the age prevalence between developed and developing countries. The occurrence of low lactase activity and lactose malabsorption seems to begin as a postweaning phenomenon in developing countries while in nonwhite subjects in the U.S.A. and in Japanese there is a considerable shift to the higher age groups. This observation required confirmation by appropriate studies on different age groups in the different countries in various stages of development to evaluate the role of secondary environmental factors.

2.4 Practical implications

An examination of the practical implications of the finding of low lactase activity and lactose malabsorption in the majority of the population of the world would need background information regarding the form and quantities of animal milk consumed in the developing countries of the world and the purpose for which milk is used in various nutritional programmes. Milk is considered a virtually complete food and nutrition experts have always encouraged its consumption. In the developing areas of the world, where protein deficiency is widespread and PCM a serious childhood disorder, the use of milk is strongly advocated, depending on availability, for child feeding programmes, for treatment of PCM, for use in regular hospital diets and for supplementation of the home diet of the nutritionally vulnerable groups.

2.4.1 Milk usage in the home. In many countries in the developing areas of the world, milk and milk products are expensive articles of food and are usually consumed by the elite group. Culturally, the population in some of these countries has acquired the milk consuming habit only in the recent past, while in others, the population has a long history of consumption of milk and milk products. There is a complete lack of accurate data on the actual amount of milk consumed and the forms in which it is taken in the diet by the different socioeconomic.groups in the developing areas of the world. In future studies on this problem, it is of cardinal importance to make reliable determinations of the amount of milk consumed. Information volunteered by parents or by children is often inaccurate and cannot be used in interpretations.

Since milk production is low and its cost high, adults in the family generally consume small but variable quantities of fluid milk as such or mixed with coffee or tea. It is not uncommon to ferment milk and use it in various preparations. The children of the privileged families receive fluid milk regularly as a supplement to their daily diet. In the case of the large majority, however, animal milk as an article of food enters the diet only in modest amounts and irregularly due primarily to high cost and nonavailability.

2.4.2 In the hospital. The use of milk as an article of diet for severely ill patients has been in vogue for a long time. With the rapid development of milk technology leading to production of a variety of dried milk preparations, the provision of some quantity of milk for all inpatients has become a common practice. During the last three decades, the main plank in the treatment of PCM has been feeding reconstituted milk powder.

2.4.3 Treatment of PCM with milk. Because of the high quality of protein and other essential nutrients, milk remains the standard treatment for various forms of PCM. In many parts of the world where malnutrition is prevalent, infantile and weaning diarrhea present a major health problem and often precipitate kwashiorkor and nutritional marasmus. PCM and recurrent diarrheal disease are often associated with abnormalities in the intestinal mucosa, including flattened villi, leading to malabsorption (15).

All investigators who have had experience in treating PCM have reported the occurrence of diarrhea in a certain percentage of the cases during the early weeks of milk therapy. However, one rarely has been compelled to suspend milk administration since the diarrhea subsides and the children recover.

In view of the great value of milk in the treatment of PCM and the disappearance of clinical manifestations of intolerance with the improvement of absorptive functions, it is considered that lactose intolerance need not pose any problem insofar as protein therapy of PCM with milk is concerned. Certainly if the diarrhea persists or appears to be aggravated by milk treatment, if would be desirable to provide adequate calories and proteins from some mixture low in lactose.

In this connection, the excellent response to use of K-Mix-II (UNICEF), which contains "food-grade" calcium caseinate 3 parts, skim milk powder 5 parts and sucrose 10 parts (by weight) with added groundnut oil, in initiation of treatment of severe kwashiorkor should be noted. (Report on Feeding the Preschool Child; PAG, 1971). Another low-lactose product, an instantized sweetened corn-soy-milk (CSM) mixture has been reported to be giving good results in treatment of severe malnutrition. Certainly there is no evidence to show that milk should not remain the basis for treatment of PCM.

2.4.4 Feeding programs. Apart from the use of milk in hospitals, large-scale community or institutionalized milk feeding programs for preschool children, school boys and girls, industrial workers, and other stress groups, are in operation in several countries. These programs, supported largely by international and bilateral agencies, are intended mainly to supplement the home diet of the participants with additional protein, prevent protein deficiency and improve the health.

A large part of the milk used in these programs and for hospital treatment is prepared from whole or skim milk powder and is obtained as donations from the developed countries.

2.5 Clinical implications for the preschool child

While there is no recommendation with regard to the amount of milk a child should receive in preschool feeding programs, they are usually given 6 to 10 fluid ounces (170ml to 285ml) of milk per day depending on availability and the age of the child. As skim milk powder, an amound not to exceed 40g is usually used in institutional feeding. Not infrequently, the mother is allowed to take home part of the daily allowance as milk powder so that the child can be fed later. The lactose content of this quantity of milk consumed in the feeding program will not work out to more than 1 gram per kilogram body weight. This amount is far less than the 2g lactose per kg used by most of the investigators to determine low lactase activity and lactose malabsorption in children. It has been reported that administration of 1g of lactose per kg of milk containing an equivalent quantity of lactose has failed to induce signs of intolerance in young children (aged 7 months to 7 years) with low lactase activity and lactose intolerance (44). While there is need for further studies to evaluate this point it may be assumed that on the whole, the quantity of milk fed in these programs will rarely lead to disturbing clinical signs and symptoms, except where a true allergy to milk occurs.

In programs intended for rehabilitation of children suffering from moderate types of malnutrition, it may be necessary to double the quantity of milk given in the preschool child programs. In such cases, it is advisable to do so by offering the milk twice a day.

2.5.1 For school children. In programs for school children, milk is provided as part of a midday meal and the amount of reconstituted skim milk given to each boy or girl varies between 6 and 10 fluid ounces, providing less than 1g of lactose/kg. Though reports of clinical investigations suggest that the prevalence of low lactase activity is much greater in this age group than in younger children, all of these are based on studies using 2g or more of oral lactose per kg body weight. Data are lacking on the clinical effects of administration of 1g or less of lactose per kg body weight or the equivalent quantity of milk. Since normal children are known to drink this quantity of milk with no ill effects whatsoever, and school feeding programs are in operation in very many places, it is believed that disturbing clinical manifestations may not be a problem of any magnitude among children receiving 6 to 10 ounces of milk, usually with a snack or midday meal.

2.6 Nutritional implications

The occurrence of low lactase activity in the majority of the adult population in developing areas of the world has made it necessary to evaluate the nutritional implications of milk consumption with special reference to the role of milk as a source of protein and other nutrients for the vulnerable groups. In individuals with clinical manifestations after milk consumption, it can be assumed that absorption of protein, lactose and other nutrients will be affected to a variable extent. However, the important nutritional concern is whether in those with no alimentary signs or symptoms and who form the large majority, milk feeding will affect the absorption of protein and other nutrients present in milk. The repeated observation that cases of PCM respond rapidly to administration of milk is partial evidence that there is satisfactory absorption of milk proteins in the small intestine.

There are a few studies on protein absorption from milk in individuals with low lactase activity and lactose malabsorption and the results suggest that absorption of milk protein is not disturbed (49). Further research is necessary to evaluate this aspect, particularly in children fed ordinary as well as lactose-free milk in different quantities commonly used in child feeding programs. Again, there is no information on whether low lactase activity affects absorption of nutrients other than protein in milk. Nevertheless, all the studies seem to suggest that a variable quantity of the lactose of milk is lost in the stools, implying a loss of calories from this carbohydrate source (7,50). More information is urgently required with respect to digestion and absorption of various nutrients at levels present in customary amounts of milk by persons with low lactase activity to adequately evaluate the nutritional significance.

Efforts are underway in many developing countries to actively promote scientific dairying and development of milk technology. Large quantities of milk and milk products are also donated through international and bilateral aid programs to developing countries as support for various large scale nutrition feeding programs. Since milk feeding is recommended primarily to offer some high-quality protein to the consumer, on the present evidence there is no need to discourage programs where the aim is to improve milk supplies and increase milk consumption.

3. USE OF LOW LACTOSE PREPARATIONS

In an individual case of proven milk intolerance with severe clinical signs related to the lactose content of milk, it may be necessary to completely eliminate milk from the diet and to substitute other food. Thus, for the dietary treatment of infants with congenital lactase deficiency and milk intolerance, industrial products are available which provide most of the other nutrients found in milk but which do not contain lactose. However, a wide variety of commercial food products, including many baby foods, contain milk and it is also widely used in food preparation in the home. It is therefore very difficult to adhere to a diet which is completely free of lactose.

The problem of low lactose preparations intended for use on a large scale in subjects with secondary or primary low lactase activity and clinical signs and symptoms of intolerance to milk consumption is of a different character. It is not necessary in such cases to reduce the lactose to very low levels or to eliminate it completely from the diet.

There now exist in the laboratory stage several methods for the reduction or elimination of lactose from milk. None of them has, however, reached industrial production and the price for such products may prove relatively high.

3.1 Methods of reducing lactose content

3.1.1 Enzymatic reduction of the lactose content of of milk. At least one such product (Zymil), in which the lactose content of the milk has been reduced from 5% to 0.5%, has been tested with seemingly good results (51). Mention has been made in the literature of a possibility of reducing or eliminating lactose by using insoluble lactase built into a perfused column (27,52). The enzymatic methods have the advantage that the products (glucose and galactose) are retained and thus the nutritional value remains unchanged.

It should be mentioned in this connection that traditional milk fermentation procedures (as used by large population groups all over the world for the production of yogurt, kefir, etc.) as a rule result in only a modest reduction of the lactose content of the milk from 5% to 4%.

3.1.2 Elimination of lactose from milk by gel filtration. The introduction of the principle of SEPHADEX filtration has been a decisive step forward in the separation of organic compounds from other compounds in a solution. This method has also been tried in at least one country (Sweden) for the elimination of lactose from milk. On a small-scale basis this has proven quite feasible. However, for large-scale industrial production technical problems still remain to be solved and the economics of such a procedure are not yet clear.

3.2 Vegetable milk

In some areas, soy-containing beverages have achieved considerable popularity. They do not contain lactose and may be of interest where milk intolerance due to lactose malabsorption is concerned.

In some proprietary formulas the desirable increase in carbohydrate content is reached by adding lactose. This is of no harm while infants are concerned, but at least in one country (Egypt) products of this kind are so popular that they are consumed also by older children and adults. In such situations, the use of lactose (in order to mimic the composition of milk) instead of other disaccharides may prove to be a disadvantage because of the large number of subjects with low lactase activity.

3.3 Stretching the available milk supply

The supply of milk in the world market has been changing widely. The surplus recorded in past years in the industrial countries has in recent times dwindled. For this reason, and also with the intention of reducing price, considerable attention has been given during the last decade to "low-cost protein-rich foods" based mainly on vegetable mixtures, but often containing a small amount of dried skim milk (5-10%). Examples of such products are Superamine (Algeria); Corn-Soy-Milk (CSM), (Food for Peace, U.S.A.) and Faffa (Ethiopia). These products have a satisfactory nutritive value and are at the same time low in milk (and lactose) content.

On the whole, the trend to be foreseen with respect to the use of milk in food, especially in developing countries, is toward supplementation to improve the nutritive value of lower quality dietary protein. This would, in effect, result in the use of skim milk powder less for reconstitution to fluid milk and more as a component in mixtures with other foodstuffs, both in industrial products, as referred to in the previous paragraph, and in the preparation of foods in the home. Usually this will mean a reduction in the milk (and lactose) used in individual meals and the daily consumption of milk.

4. RESEARCH RECOMMENDATIONS

4.1 Prevalence studies

Further data on the prevalence of low lactase activity in non-Caucasian population groups using standardized procedures should be obtained.

Such studies will be of special value if emphasis is given to the following aspects:

a) Collection of data on a systematic basis covering the whole preschool and schoolage groups in the general population.

b) Parallel studies to obtain quantitative data on the regular milk consumption of the groups under study. This is a difficult process and requires careful preparation with multiple checks.

c) Collection of similar information from both children and adults from non-Caucasion populations habitually consuming milk as an essential part of their diet.

4.2 Clinical studies

The following aspects are recommended for further study:

a) The relationship between lactose intolerance and milk intolerance. It has been clearly stated (e.g. from India) that the same amount of lactose is more apt to cause signs of intolerance if it is given as a lactose-water mixture rather than as milk.

b) Systematic studies on the effect of individual nutrients (proteins, fats and fatty acids of different chain lengths, starch, dextrins, etc.) on the proneness of the individual to react with signs of lactose intolerance and the mechanism of such effects, if any.

c) The adaptation problem needs further elucidation. Two aspects offer themselves for further study:

- i) Will prolonged administration of milk, within tolerance limits, increase lactase activity in subjects with primary low lactase activity?
- ii) Will subjects with milk (lactose) intolerance on prolonged administration of milk (within tolerance limits) show an adaptation to successively increasing quantities of milk even without any increasing lactase activity? If so, what is the underlying mechanism?

4.3 Metabolic studies

These studies should be undertaken only in institutions which possess all facilities for carrying out this type of work. The following aspects need investigation:

a) The utilization of the major milk constituents (protein, fat, lactose) in subjects with lactose intolerance.

b) Similar studies on subjects with low lactase activity but without overt signs of lactose intolerance.

c) The utilization of major milk constituents by children with severe protein-calorie malnutrition (marasmus and kwashiorkor) both during the acute phase and in the recovery phase.

4.4 Technological studies

These should aim at developing milk with low-lactose content or "milk-like products" with little or no milk content:

a) Elimination of lactose from milk by use of enzyme-fixed lactase beds (retains glucose-galactose and thus keeps the nutritional value of the milk unchanged).

b) Use of lactose adsorption techniques (the lactose eliminated must be substituted by other carbohydrates).

c) Studies on natural fermentation, the extent to which the lactose content of milk can be reduced and the acceptability of such products.

d) Development of low-cost protein-rich foods fulfilling the criteria of PAG Guideline No. 8.

4.5 Methodology

The ad hoc Group suggests that PAG recommend that the Sponsoring Agencies develop a protocol on methodology for use in field studies and aimed at the determination of the prevalence of low lactase activity and of milk (lactose)intolerance. This may be done with the help of a consultant or by arranging a small workshop.

4.6 The problem of milk (protein) intolerance

This has been referred to previously (para. 1.5, p. 4). Data so far available indicate that undenatured milk protein when consumed in larger quantities by infants and young children may cause considerable loss of blood and consequently protein from the gut.

It is important to elucidate further:

a) Whether this phenomenon which has been studied mainly in the U.S.A., bears significance also in other parts of the world.

b) To what extent milk and milk-containing products widely used in the developing countries have their proteins denatured.

c) Whether milk (protein) intolerance can occur even with ingestion of milk in low or moderate quantities.

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Appendix I

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Appendix II

AGENDA

9:30 a.m. 1. Opening the meeting and introductory remarks.

2. Adoption of agenda.

3. Prevalence of milk intolerance - a critical review of published literature;
   (a) North America and Europe
   (b) Africa and Middle East
   (c) Asia, Far East and Oceania
   (d) Latin America

4. Types of milk intolerance - distinguishing features; a review of diagnostic tests and their merits; screening tests for field application and experience of their use; development of practical guidelines for future studies.

5. Pathogenesis of milk (lactose) intolerance - current concepts; inconsistency between milk and lactose intolerance; between clinical picture and laboratory tests; possibility of adaptation and reestablishment of tolerance.

6. Practical implications of the use of milk and milk products in developing countries.

7. Prevention of intolerance - value of low lactose preparations, vegetable milk, etc.

8. Research recommendations.

9. Formulation and adoption of report.

Appendix III

LIST OF BACKGROUND DOCUMENTS

1. Prevalence of milk intolerance - Europe and North America by B. Vahlquist. (Document 1.27/6).
2. Prevalence of milk intolerance - Africa and Middle East by Prof. Ransome-Kuti
3. Studies on milk intolerance by Dr. Vinodini Reddy. (Document 1.27/2).
4. Studies on milk intolerance: a review of literature for Latin America by R. Luyken. (Document 1/27/3).
5. Criteria and usefulness of tests for diagnosis of milk intolerance by G.G. Graham. (Document 1.27/7).
6. The pathogenesis of milk intolerance with special reference to lactose intolerance by M.C. Latham and M.E. Macquarrie. (Document 1.27/5).
7. Milk intolerance - practical implications by PAG Secretariat. (Document 1.27/4).
8. Milk intolerance - nutritional implications by O. Ransome-Kuti.
9. Scientific rationale for the use of acidified and fermented milks in feeding infants and young children by O. Ballarin. (Document 1.14/19).
10. Scientific rationale for the use of acidified and fermented milks in feeding infants and young children by M. Gabr. (Document 1.14/16).
11. Scientific rationale for the use of fermented milk in infant feeding by V.K. Tatochenko. (Document 1.14/20).

Summary

PAG AD HOC WORKING GROUP MEETING ON FEEDING THE PRESCHOOL CHILD*

The following three subjects were discussed at the meeting: standards and regulations for special foods for infants and young children; the need for legislation for protection of working women during pregnancy and lactation; and use of home-prepared legumes and green leafy vegetables for infant and young child feeding.

The Working Group had the opportunity to review the recent reports of the Codex Committee on Foods for Special Dietary Uses pertaining to infant formulas and cereal-based processed foods for infants and children. Comments were offered both on the nutritional composition of the products and on the need for a clearer definition of the purpose for which these products will be used in the developed and developing countries. General recommendations were made with regard to the principles and guidelines underlying the composition, sanitary conditions and safety, nutritional content, labeling requirements, marketing and production and subsidized distribution of protein-rich foods. The ad hoc Working Group's report has been made available to the Secretariat of the Codex Alimentarius Commission.

The ill effects of poor diet and malnutrition on the pregnant woman, the offspring and the woman's capacity to breast feed after delivery are considerably multiplied and aggravated in the case of working women who are employed under unsatisfactory conditions outside their homes. The Group was particularly concerned with the inhibitory effects of the working environment on breast feeding and the serious consequences of this for the young infant. The current legislative practices in different countries were reviewed briefly and the Group recommended that the duration fixed for postnatal leave should take into consideration the needs of the infant and the emotional aspects of the mother-child relationship. The special problems in the developing countries were examined and the need for coordinating maternity protection measures with other MCH and family planning legislation was stressed.

Legumes are recognized to be one of the best plant sources of protein and are also a dietary source of some vitamins and minerals. Edible green leafy vegetables are good sources of several micronutrients. Nevertheless, these foodstuffs are rarely introduced into young children's diets in the developing countries. Admittedly there are a few problems in their regular use in infant and child feeding. The more important of these are cultural prejudices, presence of toxic and other irritant factors, and poor digestibility.

The Group considered the practical steps necessary to overcome some of these difficulties and thus to stimulate the use of legumes and edible green leafy vegetables as a part of the regular daily diet of young children in developing countries. The need for more information on certain nutritional and agricultural aspects of these two important foodstuffs was stressed and topics for further study and research were listed. The Group's recommendations will be considered at the 21st PAG Meeting in June 1973.

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*The Working Group which met at the World Health Organization Headquarters, Geneva, Switzerland, on 11 to 13 December, 1972, consisted of Dr. Bo Vahlquist (Chairman), Sweden; Mr. O. Ballarin, Brazil; Dr. J. Cravioto, Mexico; Dr. M. Gabr, Egypt; Dr. D. B. Jelliffe, U.S.A.; Mr. E. de Liniéres, France; and Dr. S. G. Srikantia, India. Mr. D. Cox, U.S.A.; Mr. D. Benton, U.S.A.; and Mr. H. R. Mueller, Switzerland, attended as consultants. Dr. N. S. Scrimshaw was also present. Agencies represented were FAO, WHO, UNICEF and ILO.

PROTEIN ADVISORY GROUP OF THE UNITED NATIONS SYSTEM

1 March 1973

21st Meeting, New York
4-8 June 1973

Document 1.14/37
Agenda item

REPORT OF THE PAG AD HOC WORKING GROUP ON FEEDING THE PRESCHOOL CHILD

Geneva, Switzerland, 11-13 December 1972

CONTENTS

	Page
List of participants	i
List of documents	iv
1. Standards and regulations for special foods for infants and young children	1
Discussion and comments on the report of the Sixth and Seventh Sessions of the Codex Committee on Foods for Special Dietary Uses	1
Regulatory aspects of foods for infants and young children and the development of protein-rich foods	6
2. Legislation for the protection of working women during pregnancy and lactation	13
3. Legumes and green leafy vegetables in child feeding	17
The use of legumes in young child feeding	17
The use of dark green leafy vegetables in young child feeding	22

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LIST OF DOCUMENTS

Agenda item 1(a)

1. Weaning preparations for infants, survey of the legislation. Dr. J. de Moerloose.

2. Legislative and regulatory aspects in feeding the preschool child. Dr. H.R. Müller.

3. Economics of feeding infants and young children in developing countries. David O. Cox.

Agenda item 1(b)

5. Report of VI Session of the Codex Committee on foods for special dietary uses.

6. Methods of analysis in standards for foods for infants and children. FAO/WHO. CX/FSDU 71/6 (Addendum).

7. PAG Guideline No. 8 of 13 October 1972.

Agenda item 2

8. Maternal and child health: legislation on the promotion of breast feeding. Dr. J. de Moerloose.

Agenda item 3

9. Use of legumes and green leafy vegetables in feeding infants and young children. Dr. S.G. Srikantia.

10. Quick-cooking legumes. PAG Bulletin.

11. The use of the chick pea in infant feeding. Dr. M.A. Tagle.

12. Summary of studies on human feeding of green leafy vegetables and legumes. Dr. R. Luyken.

13. Formulation and evaluation of low-cost balanced meals using cereals, legumes and green leafy vegetables. Dr. R. Rajalakshmi.

14. Nutritional importance of legumes in human diets. Extract from paper by Dr. R. Bressani in PAG Symposium.

15. Use of legumes and green leafy vegetables for infant and young child feeding. Dr. R.P. Devadas.

16. Flatus production in children fed legume diets.
    M.N. Rao _et al_.

17. Consumption of legumes and pulses by infants and young
    children in rural M.P., India. T. Gopaldas _et al_.

18. The role of legumes and green leafy vegetables in
    domestic multimixes for the transitional.
    Dr. D.B. Jelliffe and Mrs. P. Jelliffe.

19. Legumes and green leafy vegetables in infant nutrition.
    Dr. M. Gabr.

1. STANDARDS AND REGULATIONS FOR SPECIAL FOODS FOR INFANTS AND YOUNG CHILDREN

DISCUSSION AND COMMENTS ON THE REPORT OF THE SIXTH AND SEVENTH SESSIONS OF THE CODEX COMMITTEE ON FOODS FOR SPECIAL DIETARY USES

1.1 Background

The Codex Committee on Foods for Special Dietary Uses of the Codex Alimentarius Commission is developing world-wide standards, including those for an infant formula, canned baby foods and processed foods based on cereals for infants and children. The draft standards for the infant formula have reached an advanced stage while those for the other two are at an earlier stage. The Codex Alimentarius Commission asked the PAG to review the draft standards and offer appropriate comments and proposals, particularly on the infant formula. The Commission indicated that it would value PAG remarks on the nutritional composition of the products, with particular reference to protein quality and trace elements in infant formulas not based on milk. With regard to the drafts for canned baby foods and processed food based on cereals, comments on paragraphs dealing with nutritional composition and quality factors, food additives, labelling and methods of analysis and sampling were sought.

The PAG *ad hoc* Working Group had the reports of the Sixth and Seventh Sessions of the Codex Committee on Foods for Special Dietary Uses available to it for review.

1.2 Extent of applicability

The Group felt that a draft standard should always be considered with a full awareness of the need for the special food and the purpose for which it will be used all over the world, both in the technologically developed and the developing countries. A study of the draft report left the unmistakable impression that the standards are being drawn up primarily for products intended for use in industrialized countries. It was emphasized that the Codex should examine this question on a global basis and evaluate the needs and requirements particularly of developing countries. Many products manufactured for use in Europe and North America may find a market in the developing countries. Although legislation should aim at uniformity, a prerequisite for the introduction of stringent regulations should be that their effective application is feasible. The Group, however, was not in favor of providing two sets of standards, one for use in developed countries and the other for the developing countries.

1.3 Draft standard for infant formula

1.3.1 Scope. According to the present draft the product is for use of infants from birth to 12 months of age. The recommendation for use of the product during early infancy (0-6 months) and maintenance of a composition nearly similar to that of breast milk, would make the infant formula a breast milk substitute and the recommended amounts can be expected to fulfill the nutritive needs of the infant up to six months. Beyond six months of age, the infant formula is usually supplemented by other appropriate foods, a practice regularly followed in the technologically developed countries. If older infants (6 months-1 year) are fed on infant formula as the sole food, larger quantities have to be fed to satisfy the increasing calorie needs, resulting in a great increase in the cost of feeding. In developing countries, the mothers are known to feed inadequate quantities of the formula because of lack of funds. Not being aware of the infant's nutritional needs, they make no attempts to start feeding other foods that the infant is now prepared to eat. In such cases, the older infant often continues to be fed exclusively on insufficient quantities of the infant formula (breast milk substitute) with serious nutritional consequences. Hence, clear recommendations on the scope of the product must be made. The infant formula (breast milk substitute) if fed in recommended quantities can serve as a complete food for infants. However, if continued to be fed after six months it should be recommended that the infant should receive supplemental feedings of satisfactory nutritional content. In many developing countries the supplementation can be done through use of either appropriate home-made weaning mixtures based on cereal/legume/vegetable preparations or processed cereal-based foods. This information should appear on the label.

1.3.2 Protein quantity. The Group noted the recommendation in the draft standard regarding the minimum and maximum quantity of protein. It was agreed that a minimum quantity of 1.8g of protein/100kcal (protein quality equivalent to that of whole egg protein) was adequate when the formula in recommended quantities is used as a complete daily food for infants. However, the possibility exists that the formula will be fed beyond six months of age, not as a sole food but in amounts less than recommended levels along with a supplement of variable protein nutritional quality. As a protection against this contingency and to assure a satisfactory intake of protein by older infants, the prescription of a maximum safe level of protein was found necessary. The Group agreed that the maximum level of 4g of protein/100kcal (protein quality not less than 70% of that of whole egg protein) recommended in the draft is an adequate safeguard. In any case, increasing the level beyond 4g/100kcal of protein of any quality was considered unnecessary and wasteful of resources and may be harmful to the very young infant who will be fed exclusively on the product as a breast milk substitute.

1.3.2 Protein quality: standard and evaluation. It was felt that the use of whole egg as the reference protein is unrealistic and impractical. On the other hand, use of whole milk as a reference pattern for biological comparisons seems sound. The elaboration of a new reference protein for scoring purposes by the FAO/WHO Joint Expert Committee on Energy and Protein Requirements was noted. (See Table I).

TABLE I. SUGGESTED COMPOSITION OF REFERENCE PROTEIN PROPOSED FOR DETERMINATION OF CHEMICAL SCORE

	Proposed composition	
Amino acids	mg/g protein	mg/g nitrogen
Isoleucine	40	250
Leucine	70	440
Lysine	55	340
Methionine + cystine	35	220
Phenylalanine + tyrosine	60	380
Threonine	40	250
Tryptophan	10	60
Valine	50	310
Total	360	2,250

It was also recognized that new concepts have been recently introduced into the methods of evaluation of protein quality and an international group is meeting shortly to recommend a revised procedure. For these reasons, the Group urged that the Codex Committee be guided by the reports of these meetings when they are available.

1.3.4 Vitamins and minerals. The Group examined the recommendations regarding vitamins and minerals proposed in the draft and felt the need to have maximum quantities per 100 kcal specified in the standard. This is important since excessive intakes of certain vitamins and minerals are known to be harmful and there is no information with regard to others.

Regarding vitamin B_6, it was considered an advantage to relate its level to the protein content of the product, which will eliminate the need for a maximum and minimum figure. Fifteen to 20 mcg of B_6 for every gram of protein per 100 kcal in the formula was suggested as a safe recommendation.

The possibility of harmful effects of manganese in high concentrations on the health of infants and children was noted. Since the Group did not have data on requirements and toxicity of this element and a special WHO/FAO Expert Committee is meeting in April 1973 to discuss the several aspects of trace-element nutrition and requirements, it was suggested that the Codex Committee avail itself of this report.

1.4 Processed foods for infants and children based on cereals

The PAG Guideline No. 8 (revised 13 October 1972), "Protein-rich mixtures for use as supplementary foods", was available as a meeting document and the Group took note of the recommendations contained in this guideline before making comments on the Codex Committee draft standard on processed foods based on cereals. The paragraph on scope contained in the draft standard states that it is intended for use during the weaning period of normal infants (0-12 months) or to supplement the diet of children (1-3 years). With successful lactation by the mother, the weaning period of normal infants need commence only after 4-6 months of age. In the light of the nutritional composition proposed in the standard, the statement on scope is acceptable only for developed countries where the diets of infants and children always include foods rich in proteins and various other nutrients. It is believed, however, that the nutritive value of the cereal-based product will not be less than that of the cereal from which it is made.

In the developing countries, the foods given to infants over six months and young children are not always adequate. It should be recognized that the processed cereal-based product, used either as a supplement to the home diet or as a total food for the older infant or young child, should be able to provide the daily need for protein and for vitamins and minerals. This makes it essential to prescribe a minimum level of these nutrients for the processed food intended for this use.

In view of the special needs of the developing countries and because of the difficulty of proposing a single protein content satisfactory for all nutritional situations, the Group recommended that the proposed draft standard should include two categories of cereal-based foods for the use of infants and children. The first category will have no minimum level of protein set and the label will clearly state that this food should be mixed with milk before being fed to infants and children. The second category will have a minimum protein content of 15% w/w and will follow the composition prescribed for protein-rich mixtures for use as supplementary foods in PAG Guideline No. 8. This product will not require mixing with milk before feeding.

The Group noted that there are separate Codex Committees to consider and comment on labelling practices and food additives and drafts on these aspects are under preparation. It was recommended, however, that the label information provide a list of the ingredients and additives giving their specific names, the nutritive components expressed per 100 kcal along with the total number of available calories per unit weight and detailed directions in local languages, with diagrams, on how to make the preparation and how to feed it.

The draft standards for canned baby foods were not discussed. However, the Group noted the problems this type of baby foods create in families with inadequate funds and felt the need for correct and easily-understood labelling, revealing the nutritional weaknesses of such products for infant and young child feeding under these circumstances.

REGULATORY ASPECTS OF FOODS FOR INFANTS AND YOUNG CHILDREN AND THE DEVELOPMENT OF PROTEIN-RICH FOODS

1.5 Background

Rapid advances in the science of nutrition and food technology have led to the availability of a variety of processed food products for use in feeding infants and children. However, legislation dealing with such foods has not kept pace. A review of the available national legislation applicable to weaning foods indicates that the legislative provisions are mostly outdated and are characterized by major gaps, sometimes leading to interference with proper nutritional and quality control. There are also significant differences in existing legislation between one country and another which create obstacles to free movement of infant foods in international trade.

The Codex Alimentarius Commission of the Joint FAO/WHO Food Standards Programme is taking steps to correct this situation. The Committee on Foods for Special Dietary Uses of the Commission is at present preparing draft standards for these categories of foods for use of infants and children: an infant formula based on milk and nonmilk sources, processed food for infants and children based on cereal and canned baby foods*. The Committee has no draft under consideration at present for protein-rich foods. Since the current draft of the Codex Committee on processed foods for infants and children based on cereals cannot meet the nutritional needs of infants and children in the developing regions of the world, the Group would strongly recommend the inclusion of two categories under the existing draft. The first category would be "Cereal-based foods" and fit the existing draft standard. A new second category would be added entitled "protein-rich foods with a cereal base"**. This idea is emphasized in paragraph 1.4.

For "protein-rich foods with a cereal base", PAG Guideline No. 8 on protein-rich mixtures for use as supplementary foods could be used as a basis for further action. In the following paragraphs a few general guidelines and principles in the development of such standards for protein-rich foods are indicated.

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*See previous sections of this report for comments on some aspects of these draft standards.

**In areas of the world where tubers or starchy fruits rather than cereals form the staple, it may be necessary to develop a protein-enriched food. This can be done by fortifying the staple with a protein-rich food or by other appropriate methods and processing it for use in feeding infants and young children. It may be necessary to draw up standards for such protein-enriched foods before they are used for feeding infants and young children.

1.6 Composition

The ingredients will of necessity depend on suitable mixtures of available locally-grown protein-rich foodstuffs such as edible legumes and oilseed meals. A judicious combination of two or more of these foodstuffs or protein concentrates or if necessary, protein isolates prepared from them, along with the staple cereal flour as the base will provide a well-balanced mixture. The basic formula of such a mixture should not be rigid and should provide ample scope for interchangeability. Alternatives will be determined largely by the availability of the material. The PAG has presented guidelines for preparing food-quality groundnut flour, edible cottonseed protein concentrate and edible heat-processed soy grits and flour (PAG Guidelines Nos. 2, 4 and 5).

1.7 Sanitary conditions and safety

At the international level, the responsibility for developing regulatory measures concerning the "sanitary conditions and safety" of foods for infants and young children has been entrusted to the Codex Committee on Food Hygiene. The Committee will in due course prepare a specific code of hygienic practices for foods for infants and young children which will give attention to their special problems such as high susceptibility to infection by alimentary pathogens and severe response to all toxins.

The raw material for these formulas must be of good quality and be free from pathogenic organisms and their toxic substances. If the raw material received pesticide treatment it must have been conducted according to good agricultural practice; if not, special analyses must be carried out. The weak point in the use of dried formulas is often the reconstitution phase at home and this is usually beyond the control of local health authorities. Errors could be minimized if the following two precautions were followed regularly: boil reconstituted formulas before feeding and discard all leftovers.

PAG Guideline No. 11, "The sanitary production and use of dry protein foods", deals with the basic requirements for food processing plants engaged in the manufacture of such foods, the microbiological criteria of acceptance to be applied to the finished product, precautions during and after reconstitution of the foods and methods of analysis and sampling plans.

1.8 Nutritional content

It is essential that the nutrient content always be expressed in units per 100 kilocalories as well as in units per 100 grams, irrespective of the category of the food product. The Group recommended that the values for protein quality and quantity mentioned in PAG Guideline No. 8, "Protein-rich mixtures for use as supplementary foods", be adopted for protein-rich foods.

With regard to the determination and expression of protein value, several methods such as the chemical score, lysine availability, protein efficiency ratio (PER) and net protein utilization (NPU) are being used. It was recognized that newer concepts have recently been introduced for evaluation of protein quality and revised procedures may be recommended for use in the near future. Since standards to be embodied in regulations must be formulated in a uniform and precise manner, it may be necessary to await publication of new recommendations.

The level of lipids, linoleic acid, vitamins and minerals proposed in PAG Guideline No. 8 was considered reasonable. Since vitamin B_6 deficiency is now recognized as a definite clinical entity, the Group recommended amending PAG Guideline No. 8 to include regular addition of vitamin B_6 to the protein-rich food. The level of vitamin B_6 added may be related to the protein content of the product, 15 to 20 mcg for each gram of protein/100 kcal.

Rehydration and cooking often leads to a bulky, low-calorie-density preparation. The use of appropriate modern technological processes will not only reduce the cooking time considerably, but also provide a more concentrated cooked preparation with minimal bulk, maximal protein availability and maximum calorie density.

1.9 Labelling

The Group noted that a special Codex Committee on Labelling is actively engaged at present in drawing up requirements for products intended for feeding infants and children. Since the label and the literature accompanying the product are often the only means of communication between the manufacturer and the user, it is important that the label/ leaflet contain all essential information in simple and clear language understandable locally. This information should include the nutrient value expressed per 100 kcals, age range for which the product is intended as a safe food, whether it should be used with milk only, the dietary context in which it should be fed to other age groups, method of preparation and manner of feeding with appropriate easily-understandable drawings or pictures, specific source and amount of various ingredients used in the manufacture, etc. The U.S. Food and Drug Administration recently published regulations providing for nutritional labelling for most packaged foods. The regulations cover listing of nutrients including vitamins and minerals in percentages of RDA, checking on health claims for food supplements and other related provisions. The new rules are expected to help consumers and provide relevant nutrition education.

1.10 Marketing and promotion

The Group endorsed previous PAG recommendations contained in the following publications: "Feeding the preschool child - report of the PAG ad hoc working group" (Doc. 1.14/5), p. 29; and PAG Statement No. 23, "Recommendation for the promotion of processed protein foods for vulnerable groups". Some of the relevant recommendations made in these publications are restated below.

Food industries should share with the health profession and government the responsibilities for nutrition education of the public, starting with correct feeding of pregnant women. The motivation and the materials employed in promotional campaigns must take into account the local culture, economics and hygienic environment. Food industry leaders should be involved constructively in the solution of the special nutritional problems of vulnerable groups, particularly in developing countries. The importance of breast feeding should be stressed in employee training and personnel instructed not to discourage breast feeding in any way. Industry should train its personnel adequately in matters concerning local public health norms, needs and regulations so that their activities are supportive of national food and nutrition policies and programs. It should be recognized and emphasized that the immediate postpartum period and the hospital nursery are not appropriate for any promotion of infant foods directed at other than professional personnel. Special attention should be given to the importance of unambiguous and standard ways of making up dry and liquid preparations for child feeding to minimize misuse. The needs of illiterate as well as literate persons should be considered in designing labels and label design and literature should foster hygienically-oriented practices such as the use of boiled water and the proper cleansing of utensils.

As a rule products such as those described in PAG Guideline No. 8 should not be recommended for infants below six months of age. The market introduction and the promotion of these products should be carried out in close cooperation and contact with the health authorities, after obtaining the support of pediatric associations. Whenever possible, products of this kind should be produced within the country. If they are imported, and especially if they are donated and intended for free distribution, great care must be taken not to weaken the interest and possibility of initiating production on a national level. Products distributed through health centers and similar institutions should be available in the market. In parallel with the introduction of products of this kind, efforts to improve education on nutritious home-prepared weaning foods should be intensified.

The PAG has also published Guideline No. 10,"Marketing of protein-rich foods in developing countries", which sets out in great detail the whole process of planning, formulating and controlling new programs.

1.11 Subsidized distribution

The costs of manufacture and distribution of protein-rich foods usually do not permit selling such products at prices within the reach of some socioeconomic classes highly in need of them. To overcome this difficulty, it may be necessary for the governments concerned to include in the regulations for such products some special provisions. Recommendations for some of these provisions are contained in PAG Statement No. 23 and are reproduced below.

Governments should take the following steps to assist the introduction of nutritious foods for infants and young children at the lowest feasible cost:

a) Initiate specific legislative action to reduce direct and indirect fiscal burdens on processed infant and weaning foods.

b) Consider subsidy programs to provide nutritious protein-rich infant and weaning foods to the most vulnerable and the lowest income groups. In some situations, governments should provide also for free distribution of supplementary foods to the vulnerable groups in the lowest income families.

c) Provide strong support in organizing and financing educational programs to establish correct product usage, including situations where the products are provided free or at low cost. Such programs should be carried out in close collaboration with physicians caring for mothers and children and with the industry involved. Maternal and child health centers and mothercraft and nutrition rehabilitation centers should be recognized as useful channels for this educational work.

d) Stimulate use of mass media channels for both educational and product promotion communication.

e) Encourage recognition of promotion as an essential component of any marketing program to establish widespread consumer use of nutritious foods for children. For approved products, governments should give active support to promotion programs, including, where possible, financial assistance as well as provision of trained personnel and communications facilities through health services.

With regard to special formulas intended for young infants (0-6 months), otherwise designated breast milk substitutes, the Group endorsed the recommendations made in the PAG publication "Feeding the preschool child - a report of a PAG ad hoc working group" (Doc. 1.14/5), pages 23 to 28. Some of the desirable qualities of these products listed in this publication are as follows:

In the case of formulations intended for early weaned infants (less than 6 months), careful attention must be paid to the choice of ingredients, adequacy of testing procedures, the consistency of the final preparation for consumption and the suitability and hygiene of the feeding utensil. The formulation should have the following attributes:

a) Contain all the necessary nutrients, probably including some lactose, in satisfactory balance.

b) Cost as little as is feasible, consistent with sound pediatric nutrition.

c) Be safe as to composition and also with regard to possibilities of microbiological problems in the use of the preparations.

d) Have appropriate prestige and status.

e) Require only simple preparation before consumption.

f) Be easily digestible without undue "bulkiness" in passing through the infant's stomach.

g) Have minimal breast feeding displacement effect in the community.

1.12 References

1. Joint FAO/WHO Food Standards Programme. Codex Alimentarius Commission. 1972. Report of Sixth Session of the Codex Committee on Foods for Special Dietary Uses. Alinorm 72/26. January.

2. Joint FAO/WHO Food Standards Programme. Codex Alimentarius Commission. 1972. Report of the Seventh Session. Alinorm 74/26. October.

3. FAO/WHO Expert Committee on Protein and Calorie Requirements. 1973. Report.

4. PAG. 1971. Protein-rich mixtures for use as supplementary foods. Guideline No. 8. Protein Advisory Group of the United Nations System, New York, N.Y. 10017, U.S.A.

5. PAG. 1970. Preparing food-quality groundnut flour. Guideline No. 2. Protein Advisory Group of the United Nations System, New York, N.Y. 10017, U.S.A.

6. PAG. 1970. Preparation of edible cottonseed protein concentrate. Guideline No. 4. Protein Advisory Group of the United Nations System, New York, N.Y. 10017, U.S.A.

7. PAG. 1969. Edible, heat-processed soy grits and flour. Guideline No. 5. Protein Advisory Group of the United Nations System, New York, N.Y. 10017, U.S.A.

8. PAG. 1972. Sanitary production and use of dry protein foods. Guideline No. 11. Protein Advisory Group of the United Nations System, New York, N.Y. 10017, U.S.A.

9. PAG. 1970. Second meeting of PAG ad hoc working group on feeding the preschool child, Geneva, 14-18 September. Document 1.14/5, Part II (Technical). Protein Advisory Group of the United Nations System, New York, N.Y. 10017, U.S.A.

10. PAG. 1972. Recommendations for the promotion of processed protein foods for vulnerable groups. Statement No. 23, Protein Advisory Group of the United Nations System, New York, N.Y. 10017, U.S.A.

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2. LEGISLATION FOR THE PROTECTION OF WORKING WOMEN DURING PREGNANCY AND LACTATION

2.1 Aim of maternal protection

The purpose of legislation for "maternal protection" is to benefit both the mother and the young infant. Leave during the last part of gestation offers protection against premature delivery and leave after delivery provides rest and convalescence for the mother and helps her to take care of the infant in many ways including breast feeding. Successful lactation and breast feeding may also act to a certain extent as a natural contraceptive.

In developing countries breast feeding is fundamental, since it safeguards the infant's health both through adequate nutrition and protection against infection. The young infant receives the best care and emotional stimulus through constant contact with its mother which is necessary for proper development of personality in later life.

2.2 Nutritional vulnerability of working women and their children

Pregnancy is a nutritional strain on the woman, the more so if it is repeated at short intervals. There is ample clinical and experimental evidence to demonstrate that poor nutrition of the pregnant woman has an adverse effect not only on the mother herself but also on her unborn child.

Poor nutrition during pregnancy, and subsequently during lactation, may also adversely affect the capacity of the mother to breast feed her baby. Under poor hygienic and economic conditions, such as those prevailing today for a majority of the population in most developing countries, complete breast feeding during the first 4-6 months of life and partial breast feeding up to 12 months or longer is of paramount importance. Any factor interfering with breast feeding may have serious effects, such as high morbidity and mortality in the young child and the risk of long-term, developmental defects in the survivors.

Under the influence of Western culture, a declining interest in breast feeding has been observed lately in many developing countries. Urbanization and changing technology have contributed to this by increasing employment of women outside of the home. The potentially serious results of this development for the young child must be carefully observed and assessed to protect the working woman's health during pregnancy and to provide her all facilities for nursing her baby after delivery. It was these considerations that provided the overall motivation for discussion on the subject of legislation and for drawing up recommendations.

2.3 The dangers of early weaning

In a technically-developed country, early weaning (0-6 months of age) today does not imply any great danger to the infant since formulas which satisfy the nutritional needs of this particular age group are available and the mothers are informed about their proper use. There are other reasons, however, even in developed countries, for the emphasis given to measures providing women employees with special leave in the pre- and postpartum period. This has to do with a wish to preserve the mother-child relationship and thus lay the foundation for future harmonious emotional development.

For the majority of the population in a developing country, from a nutritional point of view, the situation is completely different. Inexpensive, nutritious formulas are rarely available and there is no guarantee of their hygienic handling; under these conditions early weaning is an overwhelming threat to the health and life of the young child.

From the foregoing it should be clear that a great effort is needed to protect mother and child through pertinent legislation and that this is true both for the developed and for the developing countries. One further argument for this attitude could be added, as far as the developing countries are concerned. If the ill effects of early weaning were counteracted to some extent, this would save the importation of infant formulas with a corresponding outflow of a considerable sum of currency.

2.4 International Labour Organisation (ILO) conventions and legislation on maternity protection

The Group observed that great efforts are being made to improve the standards and availability of infant foods now on the market. However, few concrete measures have been taken to promote breast feeding. The relevant ILO Conventions (Nos. 3 and 103) and Recommendation (No. 95) relating to maternity protection, which embody a coherent set of standards, have been ratified by a relatively small number of countries. It was recognized that nonratification did not necessarily imply that measures provided for in the Conventions (prenatal and postnatal maternity leave, maternity benefits, facilities for nursing mothers to breast feed their infants, etc.) were not applied in that particular country. Some had in fact instituted beneficial measures beyond those prescribed in the Conventions and Recommendation, particularly as regards the extension of paid maternity leave permitting the mother to remain at home with her infant, if she so wished, without prejudice to her employment rights and benefits. On the whole, however, the impact of measures taken for maternal protection, legislative or otherwise, in many countries, including technically advanced ones, still leaves much to be desired.

Some of the legislative measures which have been taken to promote breast feeding are the stipulation that midwives encourage mothers to breast feed and the provision that breast feeding is, except if medically contraindicated, an intrinsic obligation of the mother. The value of such regulations as a means of promoting breast feeding may be difficult to assess.

Maternity protection legislation should of necessity be framed in such a way as to avoid placing a heavy financial burden on the owner of a private undertaking. It would be undesirable to adopt provisions which would require maternity benefits to be paid mainly or entirely by such individual employers. Other ways involving private insurance or governmental contribution on a tax basis must be considered. The position in this regard is, of course, somehwat different in countries with a centrally-administered economy.

2.5 Duration of postnatal leave

From the point of view of the nutrition and health of the infant and the emotional aspects of the mother-child relationship, the first six months are crucial. The Group strongly recommended that the duration fixed for postnatal leave take these factors into account.

2.6 Developing countries - the current status

In the developing countries a rapid disintegration of traditional patterns of society is taking place through the influx of large groups of the population to urban areas and the growing employment of women in industry. Appropriate legislative and other measures must be taken to deal with this growing problem which has far-reaching effects on maternal and child health.

Even where legislation already exists, failure of implementation may occur for various reasons; this is unfortunate because of the serious effects of malnutrition in early childhood. Nonimplementation of the provisions of the legislation will have even more harmful effects in this area than in other fields of health legislation. Where a gap in implementation exists, it is often difficult to narrow or close it because of the prevailing socioeconomic conditions.

2.7 Social measures outside legislation

Continuing education at all levels on matters of health of the mother and child can be of importance and the modern techniques available for this purpose should be used. It may help a great deal if female health professionals are stimulated to practice breast feeding themselves when they have a baby so that they can serve as an example to the community. Education in regard to breast feeding should be given more emphasis in medical and nursing schools and in health education programs in general. Special attention should be given to the health care and health education, particularly in regard to nutrition and mothercraft, of pregnant women and nursing mothers. The obligation to provide such care and education should rest with both the general and the occupational health services. The Group noted that ILO standards, particularly those regarding the nature and conditions of work, provide certain guidelines in this area.

In taking measures for maternity protection, both legislative and otherwise, it is essential to coordinate these with other maternal and child health legislation, notably that dealing with family planning.

2.8 Recommendations

The Group recommended that:

a) A compilation of all existing legislation in this area, including the details of all provisions, would be of great value. This could be undertaken jointly by ILO and WHO, in collaboration with other UN agencies, and the actual compilation could be carried out by a consultant appointed for the purpose.

b) An agency, preferably ILO, could undertake a further world survey on the implementation of its maternity protection standards, similar to that carried out in 1964 and 1965, the results of which were considered by the 49th Session of the International Labour Conference. In addition to a world-wide survey of this nature, it would be of interest to examine the historical background and, if deemed feasible, to conduct case studies in depth of the actual implementation of legislation and other related measures pertaining to maternity protection and infant care in a limited number of countries.

c) A further study be made on the problem of what authority should have responsibility for the wages, salary or other remuneration of the working mother during maternity leave.

2.9 References

1. ILO. 1965. Report of the Committee of Experts on the Application of Conventions and Recommendations, Part III, Report III (Part IV). 49th Session of the International Labour Conference. The International Labour Office, Geneva.

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3. LEGUMES AND GREEN LEAFY VEGETABLES IN CHILD FEEDING

THE USE OF LEGUMES IN YOUNG CHILD FEEDING

Many different legumes are found throughout the world, with certain species dominant in particular areas and each species represented by a large number of varieties (1).

3.1 Nutritional value

Nutritionally, legumes are recognized as being the best plant sources of protein, up to 25% in dry grains with soy having up to 40%. The limiting essential amino acid is methionine. However, as has been discovered pragmatically in many communities over the centuries, appropriate cereal-legume mixtures can supply the complete range of essential amino acids. Examples include the tortillas (corn) and frijoles (beans) of Mexico, the rice and dhal (legume) of India, and the rice and soy preparations of China.

The nutritional value of legumes is suggested by the fact that it is possible for vegans*, apart from a B_{12} deficiency in some, to maintain good health on a carefully-selected vegetarian diet (2) and by the fact that severe protein-calorie malnutrition can be cured by an appropriate mixture of cereal and soy or peanut protein without any source of animal protein. Unfortunately there is a wide variation in nutritional composition (including biological value), flavor, cooking properties, etc., not only between different legumes but also between different strains of a single variety.

Fresh legumes are dietary sources of thiamine, niacin, riboflavin, calcium, folate, iron and vitamin C. The dry grain legumes, however, show little or no ascorbic acid while sprouting legumes have an increased content of thiamine and riboflavin, as well as ascorbic acid. Legumes contain approximately 60% carbohydrates, mainly starch which is well absorbed and metabolized, and also a variety of oligosaccharides.

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*Complete vegetarians, eating no foods of animal origin, including milk.

The soybean is in a special category and much is known about it. A good deal of information is available concerning the use of soy in traditional preparations, its modern technological processing and its therapeutic effectiveness in the management of protein-calorie malnutrition in young children.

Processed, vitamin-enriched "milks" prepared from soy have been used successfully as the sole food for young babies under six months of age, including allergic infants without infections, diarrhea, etc. (3). Similarly, a groundnut flour "milk" has been used as a partial replacement for cow's milk feeds in infants between 2-13 months (4). However, legumes should be considered mainly for use as weaning foods or as components of them for feeding infants and children from 4-6 months onward.

3.2 Problems in the use of legumes in the home

Although detailed quantitative food consumption data are not widely available for very young age groups in general, in developing countries legumes are rarely introduced into children's diets early in life and do not play their full role in infant feeding. There are a few problems encountered in the regular use of legumes, separately or mixed with other foods, for feeding young children at home.

3.2.1 Cultural factors. In all cultures, the different types of legumes are classified in several ways, which can be extremely important to practical infant feeding. In some areas, legumes have a low status, while in others, such as India and some other Asian countries, the opposite is often the case. Information on this point on a world-wide basis would be of great help in practical infant and child feeding.

3.2.2 Toxicity. A considerable number of toxins have been described as occurring in different types of legumes. Many of these are not of real importance from the practical point of view in young child feeding as, in general terms, legume toxins can be destroyed or decreased through adequate prior soaking and subsequent cooking. However, problems still exist with regard to the toxin in broad beans, related to the disease favism, which is common in some Mediterranean communities.

3.2.3 Digestibility. Of more importance is the well-recognized lack of digestibility of certain legumes. This property seems to vary from variety to variety within each species and is related to two main factors, the method of home processing and preparation and inherent characteristics.

The preparation of legumes can be related to the subsequent digestibility at various stages, including milling, husking, etc. The quantity eaten is also relevant, as is the state of the digestive tract itself.

Inherent properties of legumes related to their digestibility can be physical and/or biochemical. Thus, inherent physical properties include the ease of milling, especially in relation to the adherence of the gums between the husk and cotyledons which determines how firmly fixed the husk is to the endosperm.

One factor related to indigestibility, but also a deterrent in its own right to maternal acceptance of legumes for young child feeding, is the degree of intestinal gas or flatulence. Mothers complain that the amount of certain legumes they can feed the young child is limited by the abdominal distension and discomfort induced and by loose, foul-smelling stools. Very little is known about the validity or basis for these complaints and they should be seriously investigated.

3.3 Practical approaches

3.3.1 Selection. The legumes used in young child feeding will obviously depend initially on those available in the particular area. Selection will be based on cultural preferences, knowledge of nutritional composition (both protein and other nutrients), culinary attributes (including the cooking time), and apparent digestibility.

On a world basis, in the past, most attention has been paid to and most publications have been concerned with the use of three legumes in weaning foods: the chick pea (Cicer arietinum), groundnut and soybean. However, attention has also been given to the kidney bean (Phaseolus vulgaris) in Latin America and Central Africa and the broad bean (Vicia faba) in Mediterranean countries. Other legumes in other regions, such as lentils (Lens esculenta) or cow peas (Vigna sinensis), should also be considered.

3.3.2 Quantity. Defining the tolerable amount of legume that can be fed to young children is a basic difficulty. This is particularly difficult to determine since the definition of "optimal" has to take into account a number of different constraints. These include the nutritional purpose of the legume supplementation in relation to the other foods in the mixture fed at a time and in the daily diet, the actual and culturally-defined level of digestibility, and the type and preparation of the particular legume. Evidence suggests that young children of about one year of age can tolerate from 25-60 grams/day (5) of well-cooked chick peas, while 50-80 grams of groundnut flour have been used in Senegal (4). In all cases, although difficult to prove, it seems likely that "intestinal adaptability" to the newly-introduced food had taken place. It is probably wisest to introduce legumes in a relatively dilute way to start with, say a 1:4 mixture with the staple, and gradually increase the content of legume as the child becomes adapted or accustomed to the new food. Tolerance to some legumes, especially the kidney bean, also appears to increase with age.

3.3.4 Preparation. Legumes may be consumed in a variety of forms, including various green legumes eaten in the pod (an interesting combination in natural circumstances of a legume and a dark green leafy vegetable). If acceptable in the community, the possibility of using germinated or sprouted legumes needs consideration. Fermented legume preparations such as have been developed with soy in China and Japan can make the incorporation of legumes into domestic home-made weaning mixtures* for young children easier (6,7). In some communities legumes may also be available for sale in forms which seem to be particularly suitable for use in infant foods - flours, split legumes (such as the dhals of India) and toasted or roasted legumes (channa of India).

If dry whole grains are used the preparation and cooking must aim at the production of the smoothese paste possible. Skins must be removed, usually by prior soaking or following boiling. If cooking is done by boiling, it should be followed by mashing or sieving. The length of time required for the cooking of a legume and the amount of fuel needed are important factors which will determine the attitude of the mother towards its use in child feeding.

The method of preparation and cooking must also be based on local practices, as with the plantain-leaf ettu packets used in Buganda and the fermented soybean preparations such as tofu and tempeh developed over hundreds of years in Far Eastern countries. Their use in child weaning should be expanded, especially because of their easy digestibility.

There is undoubtedly a great need for applied, domestic or "grass-roots" food technology with regard to the home processing and cooking of legumes in such a way that they will be maximally digestible and will cause the least expenditure for fuel and the least destruction of nutrients.

3.4 Recommendations

Further studies should be undertaken on the identification, selection and genetic improvement of legumes, especially the major varieties. A periodic review of the activities of the international and national centers of research should be made and the results widely publicized. Further studies are needed on nutrient content, especially methionine; digestibility, including the flatulence factor; cooking properties; organoleptic properties; yield and disease resistance of legumes commonly used in the various countries. Investigations on the metabolic tolerance levels of well- and malnourished young children to legumes and legume-based "milks" are required. Special attention should be paid to studies on flatus production and digestibility at different ages.

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*Some authors use the term "multimixes" to describe these home-made weaning mixtures which represent simple mixtures of cooked cereal, a legume and a green leafy vegetable in appropriate quantities.

Research is needed on the toxic factors present, especially in broad beans, and how to eliminate these and on levels of flatus factors such as oligosaccharides, etc.

Research is also needed on village-level food technology and the preparation of legumes, including optimum practical design of domestic utensils.

Field studies are required to determine the method and level of incorporation of legumes into home-made weaning mixtures within the framework of the traditional methods.

Emphasis should be given to increased and more efficient production of legumes at low cost, special marketing incentives and storage of surpluses in drawing up food and nutrition policy in developing countries.

3.5 References

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THE USE OF DARK GREEN LEAFY VEGETABLES IN YOUNG CHILD FEEDING

3.6 Introduction

An immense variety of dark green leafy vegetables exists, many of which are known to be edible. In general, edible green leafy vegetables appear to be underutilized throughout the world and may in some areas even be diminishing in use. They are inexpensive, high-yielding, already part of the local diet and often easily available, but they frequently have a low status. Even among nutritionists the importance of edible leaves in human diets seems inadequately stressed. Among edible green leaves the darker leaves are nutritionally more desirable than the pale green ones; however, the young tender leaves are more digestible and contain less fibrous material.

3.7 Nutritional value

Nutritionally, many edible leafy vegetables are excellent sources of carotene, folate, niacin, iron, vitamin C and calcium. They are of special importance in the prevention of avitaminosis A, a major cause of blindness in young children particularly in some Asian countries. Leafy vegetables are best considered as vitamin and mineral supplements and as a minor source of protein when used in home-made weaning mixtures. They contain 3 to 5% protein in the fresh state and between 20 to 49% when dried. However, the protein is usually high in lysine and tryptophan, so that they are valuable in supplementing the amino acid deficiencies of cereals and improving the protein quality of cereal-based diets in much the same way as do legumes. They may be eaten as fresh leaves, particularly the young leaves, or in a powdered form obtained by sun-drying and/or smoking.

3.8 Some common edible leaves

The edible green leafy vegetables range through such plants as cassava, sweet potato, a variety of different types of wild amaranthus, colocasia, and many others, including wild species.

Extensive work has been done on cassava leaves, which are stated to contain between 30 to 40% of protein when dried, with 4% in fresh young leaves (1). The leaves are plucked in such a way that some are left intact to permit the tuber to continue to grow. The simplest preparation is by shredding and boiling for some minutes (up to 15 minutes for the bitter variety) which vaporizes much of the cyanogenic glucosides in the form of hydrocyanic acid; the rest is removed by discarding the water.

3.9 Problems in weaning mixtures

Leafy vegetables are not usually considered in relation to the diet of young infants (0-6 months), but rather in weaning mixtures. As in the case of legumes their use is not widespread for various reasons. Some of these are as follows:

3.9.1 Cultural factors. Leaves are not often considered for use in the food of young children during the transitional period of six months to two years. In some communities, the dark color of the leaf may lead the mother to consider the preparation indigestible by her young child. However, in many parts of the world, leafy vegetables figure prominently in the sauce eaten with the staple by older members of the family.

3.9.2 Digestibility. This seems to be related to the amount of crude fiber present, so that young leaves with the fiber removed are the most digestible. Also, certain thicker leaves may be less digestible because of mucilages and gums that are present.

3.9.3 Toxicity. The presence of pharmacologically-active substances in some leaves is suggested by clinically-recognized side effects or by chemical analyses (as with the cyanogenic glucosides in cassava leaves). Systematic studies are required to recognize such effects and identify the factors responsible.

The problem of nitrate toxicity does not seem relevant to the use of leafy vegetables in home-made weaning preparations in developing countries. This condition is of consequence in young babies of up to three months who are fed large quantities of spinach grown in areas with soils containing high nitrate levels (natural and from chemical fertilizer).

3.10 Practical approaches

3.10.1 Selection. It is obviously important to know the range of different species available in the particular area during different seasons of the year, their nutrient value and possible toxicity, and the likelihood of their cultural acceptability by the mothers concerned. Such calendars for green leafy vegetables will be highly useful in practical programs for educating mothers in their use for feeding young children.

3.10.2 Quantity. The basic question is the quantity of the leafy vegetable which may be fed to the young child in a home-made weaning mixture with benefit and with tolerance. Usually the purpose of the addition of the leafy vegetable will be to increase the intake of carotene, folate and/or iron to levels that will prevent nutritional deficiency.

Thus, in the prevention of avitaminosis A, it has been shown in southern India that children between 2-5 years of age may eat, digest and benefit from 30 grams of amaranthus each day which supplies them with 2,500 to 3,750 international units of beta-carotene. In a 3-month study, such an intake raised the serum vitamin A level from about 20mcg to about 30mcg (2, 3). At the end of this period, when the amaranthus feeding was stopped, the serum levels remained high for a period of 4-5 months thereafter. In some cases Bitot's spots disappeared.

Evidence indicates, therefore, that young preschool children can tolerate quantities of one leafy vegetable, amaranthus up to 30 to 50 grams a day. Information does not seem to be available on feeding trials before two years of age or with other edible leafy vegetables.

3.10.3 Preparation. Young leaves are preferred which can be shredded and the fiber present discarded. They can be added to the pot cooking cereal/legume near the end of the cooking, so that the leaves are exposed to heat for a relatively short period with minimal destruction of ascorbic acid and folate.

3.10.4 Leaf protein concentrate. Technological and nutritional investigations are in progress in various countries to examine the prospects of preparing and using leaf protein concentrate as a source of protein in the diet. The concentrate, as its name implies, can be expected to provide only the protein and not the vitamins and minerals which consumption of fresh leafy vegetables would offer.

3.11 Recommendations

The nutritional importance of edible green leafy vegetables in general diets should be constantly emphasized, with special relation to home-made weaning mixtures, and regular consumption should be encouraged by adopting intensive educational measures.

All available information on nutritional quality and dietary uses of familiar and not-so-familiar edible green leafy vegetables should be collected and made available to those engaged in field nutrition work.

Research is needed into the metabolic response (regarding availability and utilization of vitamins and minerals) of young children, including infants, to different amounts of various species of edible green leafy vegetables.

Systematic study of the nutritional composition, especially carotene and available folate, and toxic factors should be part of the work of well-equipped centers for research into food vegetables. Studies on yield, disease resistance, etc., are also important.

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PAG AD HOC WORKING GROUP ON FEEDING THE PRESCHOOL CHILD

The nutrition activities of local health services and emergency foods for infants and young children were among the topics discussed by a PAG ad hoc Working Group on Feeding the Preschool Child. Held in Geneva from 10 to 12 February 1975 at WHO headquarters, the meeting was chaired by PAG member Thomas Stapleton. Other items presented but not discussed at the meeting were reports on national nutrition programs in Brazil and the Philippines. (See pp. 12-15 of this issue.) Highlights of the discussions follow.

Nutrition activities of local health services

Improving the nutrition status of a population, including its children, depends on the availability of food, the socioeconomic conditions of the families, the degree of understanding of and response to nutrition and health education among family members, their awareness of the basic health and food needs, the environmental sanitary conditions and also, in large part, the extent and quality of the local health services. Since only important and minimal nutrition activities could be undertaken through local health services, the group felt it would be helpful if parallel but important programs in the field of food production, simple preservation of foodstuffs, preparation of well-balanced meals, development of proper food habits and behavior, and so forth, were to be developed. These should be directed not only to mothers, but also to other adult family members, village leaders and school teachers, and should be incorporated into the basic training of various groups of national and local government workers. Such parallel activities are essential to help support health related nutrition activities.

Preventive measures, even more than curative ones, should receive emphasis even at the first and second stages of health service development. At the present time, however, because of the rapidly deteriorating food situation in many developing countries, the curative aspects have to be given great attention. The increasingly difficult food situation will probably result in a substantial increase in the number of children affected by different types and severity of nutritional deficiencies with an ensuing increased susceptibility to infections. Facilities for treatment as well as prevention should be part of the health center activity. The degree of severity of cases that could be handled must be determined; prevention also includes keeping moderate cases from becoming severe.

Countries ought to be able to choose the most appropriate activities for their particular situation, subject to availability of trained personnel and necessary facilities. Indeed, it would be advantageous to carry out pilot studies in selected centers in the countries to determine the extent and type of nutritional load that the health center and its personnel could cope with successfully. The philosophy should be that of gradual adaptation and adjustment to nutritional activities rather than that of imposition of a mandate.

The group felt that some activities of health centers are more important and urgent than others. These should be highlighted in the centers' personnel training and supervision. Suggested as priority activities were: cleanliness, pest elimination, breast-feeding, homemade weaning foods, immunization, programs.

In a program where graded activities are undertaken at different levels, it is essential to define the roles to be played by the different personnel and to spell out clearly the responsibilities for adequate supervision and continuous coordination. Primary health services are likely to function well only if the "next higher stage" exists for supervision. The health delivery system must be viewed in its entirety. Appropriate training facilities, both formal and in-service and an adequate communication system have to be provided.

Regarding the current problem of "creeping" deterioration of the nutritional situation, the group felt that studies should be undertaken to provide a monitoring system capable of forecasting the effects of changes in food availability and prices on the one hand and child nutrition on the other. The group considered the problem important enought to be a priority item.

Emergency foods for infants and young children

The group considered the role of foods from sources outside a country in the context of decreasing supplies originating from many industrialized countries. It also discussed the common problems experienced in the supply and utilization of such foods and ways to overcome some of the problems.

Processed foods particularly meant for children during emergencies play an important role, especially during the initial stages of a disaster, and where necessary, in continued use for several months thereafter. In disasters there may be some very young infants who cannot receive breast milk; they should be provided with formulas based on milk with added vitamins A and D. These formulas or their ingredients should be clearly labelled to state whether or not vitamins have been added. If milk is not available, it is essential to provide special foods. For seriously malnourished young children, it is also imperative to offer special foods. It is desirable to provide a special mixture such as K MIX II along with the treatment necessary to initiate cure. For other children, a variety of nutritious combinations of foods can be provided, including processed weaning food mixtures commonly used in supplementary feeding programs.

Some common problems

The group noted that whereas bilateral or multilateral aid programs have been able to provide important commodities such as cereals over the years on a large scale without too many complications, considerable confusion has arisen with respect to certain foods for emergency use, particularly those meant for children. The group noted the following problems in particular:

a) Experience has shown that the continuing availability of donated foods such as milk powder and CSM is notoriously uncertain. When the supply of a product suddenly dries up, relief operations are dislocated. Often a bewildering number of products with various nutrient compositions and different methods of preparation are unloaded in irregular succession and often not in sufficient quantity.

b) Donor agencies have been largely uninterested in efforts to follow-up and study how the donated products have been put to use and their value for the nutrition and health of the intended consumers.

c) The shipment of large stocks of milk powder in various forms has encouraged the indiscriminate use of this valuable protein supplement so that all too often it has become the sole article of food for children in emergencies. The failure to provide adequate calories in skim milk powder can lead to undernutrition and other clinical problems, an example of the wasteful use of this precious protein concentrate.

Recommendations

The following recommendations were made by the group with respect to the above problems:

a) Donor governments, United Nations agencies such as the WFP and others, as well as voluntary agencies should be informed most clearly that for the time being and in all probability well into the future, there is and will remain the need for substantial commodity aid in the form of emergency food programs aimed particularly at young children.

b) In order to neutralize the adverse effects of fluctuating supplies of some widely used foods such as milk powder and CSM, governments and agencies should be encouraged to provide alternatives in the form of low-cost foods. This should be part of a preparedness program. The quantities of emergency foods needed are comparatively small in relation to those of foods (primarily cereals) that have been used in recent years in overall food aid programs.

c) There is no need to make available a large variety of products for any one emergency. Donors should be encouraged to develop food mixtures, appropriately processed, containing acceptable ingredients and conforming to the nutrient composition recommended for supplementary weaning foods.

It may well be that some countries, those who may not contribute importantly to the total world food basket, could undertake to provide most or all the needs for special emergency food programs intended for saving children. There is at least one country, Sweden, that has taken a step in this direction by preparing recipes for and guaranteeing the supply over a number of years of a sizeable amount of such emergency food. (See PAG Bulletin, Vol. IV, No. 4, pp. 26-30.)

d) In any case, research and development for such foods should take note of the suggestions and recommendations given in PAG Guidelines Nos. 6, 7, and 8. With regard to nutrient composition, the group felt that PAG Guideline No. 8 required examination and review, particularly as concerns recommended protein content. Other problems that should be tackled in revision of the guideline are the need to enhance the calorie content of the foods and the usefulness of added sugar as a means of increasing their acceptability when viewed against the varying prices of sugar in the world market.

e) Misuse of emergency foods should be minimized. They are often intended as supplements to be given along with locally available staples. Thus with milk products, they should be used as a protein additive in other foods and not be given alone except to very young infants not receiving breast milk. Misuse has been observed in two directions: in the first instance, giving the supplement alone in the recommended quantity grossly undersupplies the child with energy; in the second, giving it alone in larger than recommended quantities wastes protein and other valuable nutrients.

It follows that food packages must be labelled clearly as to nutrient composition, ingredients used, whether it is a complete food or only supplement; if it is the latter, instructions should be given on its use as an additive and on its manner of preparation. Thus consumers should be given accurate and compelling instructions on the correct use of products, and to ensure this, trained personnel should be available to make certain that such instructions are followed. The latter need becomes all the more important if, as so often happens, one type of emergency food cannot be continuously supplied resulting in the use of various products of different composition.

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PAG STATEMENT 18 ON RELATIONSHIP OF PRE- AND POSTNATAL MALNUTRITION IN CHILDREN TO MENTAL DEVELOPMENT, LEARNING AND BEHAVIOR

The PAG urges recognition of the fact that children experiencing severe malnutrition in infancy show not only permanently reduced physical growth and development but also impaired learning and behavior. The factors involved in the latter are both nutritional and social. Malnutrition beyond one year of age, including episodes of kwashiorkor, may also be associated with poor test performance during the school years and later life but this is believed to be due mainly to the social factors associated with the malnutrition rather than effects of nutrient deficiencies *per se.* Programs to ensure adequate nutrition for the preschool child can contribute to improved learning and behavior through their combined nutritional and social effects. This is one of the several reasons why programs to ensure adequate protein, calories and other essential nutrients for the preschool child should have such a high priority in nutritional planning and programs for national development.

As pointed out in the report of the Eighth FAO/WHO Joint Expert Group on Nutrition*, recent research has also provided some new insights into the relationship of fetal nutrition to mental and physical development during childhood. After 26 weeks of gestation, fetal growth in developing countries tends to slow down and results in an increase in the number of "small-for-date" babies. These babies have greatly increased perinatal morbidity and mortality rates and suffer a high incidence of sublethal damage with long-lasting effects. In general, children born of malnourished mothers are more seriously affected by subsequent postnatal malnutrition. This fall in growth of the fetus in the last trimester of pregnancy can be prevented by adequate feeding of the malnourished mother. An adequate diet during lactation is also necessary to assure optimum breast feeding of the young child. The PAG endorses the following statement in the report of the FAO/WHO Joint Expert Committee on Nutrition (Geneva, 9-13 November 1970):

"Evidence has accumulated in the past dozen years that leads to the general conclusion that malnutrition in the first year of life, if severe enough markedly to retard physical growth and to necessitate admission to hospital, may cause mental impairment (1). If the deprivation is severe and prolonged and occurs during the first months of life, the retardation of brain development and function so produced may be so severe that it cannot be completely cured by nutritional rehabilitation. The lag in mental development is not restricted to the motor components of behavior. Problem-solving ability, language, personal-social development, general intelligence, intersensory integration, and perceptual visual competence are significantly below the level obtained by siblings or matched controls. When extra mental stimulation is provided during recovery the performance obtained is better, but usually not up to the normal level expected for the particular age (2).

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*FAO/WHO. 1971. Food fortification and protein-calorie malnutrition. Eighth report of the Joint FAO/WHO Expert Committee on Nutrition. FAO Nutrition Meetings Report Series No. 49; WHO Technical Report Series No. 477.

"The lower intellectual performance and inferior learning capacity found in survivors of severe malnutrition in early life must be seen in the context of the growing body of evidence on the vulnerability of the central nervous system to nutritional insults at critical periods of development. It has been shown in experimental animals that changes in the number of brain cells, in cellularity patterns, and in myelin lipids occur only when the animal is malnourished during the period of rapid growth, when the rate of cellular multiplication is close to its maximum. Permanent effects have been obtained under these conditions, even with moderate levels of food restriction (3).

"Although many non-nutritional factors that either accompany or precipitate malnutrition can themselves probably influence mental development, it is important to remember that the age of hospitalization for severe malnutrition early in life coincides with critical periods in behavioral development, which depends on an adequate environment and opportunities for acquiring experience. The effects of malnutrition on mental performance may, therefore, also reflect interference with the gaining of experience and the differentiation of behavior.

"At present, there are not enough data to identify the particular contributions of nutritional and non-nutritional factors to defective mental function following malnutrition. Both types of factor probably have effects that are independent but that interreact. Longitudinal studies, now in progress, should enable the differential effects of these factors to be assessed. The data so far available indicate that survivors of severe malnutrition in the first year of life frequently show low levels of intelligence and a low level of competence in learning basic skills."

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13 October 1972

PAG Guideline No. 8
Supplementary Foods

PAG GUIDELINE ON PROTEIN-RICH MIXTURES FOR USE AS SUPPLEMENTARY FOODS

SUMMARY

This guideline is a recommendation for the composition of supplementary foods, including specifications for levels of protein, calories, fats, vitamins and minerals. Physical characteristics, flavor, taste and packaging requirements are also covered.

Introduction

The serious and widespread problem of malnutrition during the weaning period in tropical and subtropical countries and the inability of lower income groups to purchase sufficient animal protein foods or high-cost special children's foods calls for marketing of nutritious, low-cost mixtures based mainly on vegetable proteins mixed with other proteins where appropriate. In addition to low cost, satisfactory tolerance and acceptability on the part of the child and acceptability to the adult(s) responsible for providing the child's food are important factors. Of paramount importance, however, if the primary purpose is to be achieved, is the maintenance of minimal nutritional and sanitary standards, even though this may mean constraints in relation to cost.

Ideally, the protein food mixture should be a supplement which is patterned in accordance with the child's diet in the home and which fills the gaps with respect to calories, proteins and other nutrients. In order to be certain that the minimal needs are covered even under unfavorable dietary conditions, the supplementary food mixture should provide protein, vitamins and minerals corresponding to recommended allowances when consumed at the recommended level. The recommended daily intake of the supplement is usually of the order of 100g dry weight. These products should not be recommended for infants below six months of age unless they are specifically treated to ensure complete digestibility.

1. Level of protein

The provision of adequate protein generally presents a difficult problem during the weaning period and special attention should be given to the quality and quantity of protein in supplementary weaning foods. With protein of nutritional quality equivalent to cow's milk (NPU = 80), the level of protein in the supplementary food should be at least 15% w/w. If the quality of protein is lower, i.e. NPU less than 80, the quantity of protein should be increased as follows:

NPU	% weight/weight
80	15.0
75	16.0
70	17.1
65	18.5
60	20.0

In any case the NPU value of the protein should not be less than 60 and preferably nearer 65 and correspondingly the PER not less than 2.1 and preferably above 2.3 (casein = 2.5; the value for casein varies with different casein products and the strain of the rat used for testing.

2. Calories

The mixture should provide as many calories as possible and this may be achieved by adding fat. Poorly-digestible carbohydrate, including fiber, should be held to a practical minimum. The starchy portion of mixtures may be modified through various combinations of heat and mechanical processing or enzyme treatment, so that when prepared with water and ready for feeding, the food has minimal bulk and maximal protein availability and maximum calorie density.

3. Fat

Present knowledge does not permit specifying with certainty a dietary allowance of fat. Even so, it will be of great advantage to incorporate into protein-rich food mixtures as much fat as is technologically feasible without compromising the keeping qualities of the food. The fat will increase the calorie density of the mixture. A level of fat contributing 25% of calories to the mixture would be desirable. The linoleic acid content should be at least 1%. Without any addition of extra fat, the protein food may contain nearly 2 to 3% fat derived from the basic ingredients used in the formula. If the cost, including the need for special packaging to ensure adequate shelf-life, is found prohibitive, the addition of food fat or oil when the mixture is prepared for consumption is recommended as a possible approach.

4. Vitamins and minerals

Protein-rich mixtures should be fortified with vitamins and minerals sufficient to satisfy recommended allowances. Special attention should be given to vitamin A, riboflavin, niacin, folate, vitamin B_{12}, ascorbic acid, vitamin D, calcium, iron and iodine. Minimal quantities of various vitamins and minerals as proposed in Section 6 are recommended. However, some adjustment in the light of local nutritional problems may be considered. There may be no need to provide additional vitamins or minerals as medication to the child if the high-protein mixture is fed at recommended levels.

5. Physical characteristics, flavor and taste

Acceptability of formulated foods can be enhanced by modern industrial processing such as precooking and roller drying, extrusion cooking and enzyme treatment.. The food mixture should be formulated and processed so that by the addition of minimal amounts of freshly boiled water or by boiling after adding water it is easily and quickly prepared as a gruel or porridge of the proper consistency for feeding.

Consideration should be given to the processing of starchy components with amylases or by extrusion cooking which will a) reduce the cooking time in the home and b) reduce the viscosity and water retention capacity ("bulkiness") of the mixture, thus allowing the feeding of a more concentrated preparation. The addition of sugar to protein-rich food mixtures is permissible provided the cost is not unduly increased, since such an additive enhances acceptability. In general, however, the sweetening of the products should be carried out in the home. There is no evidence that sucrose intolerance is a problem of importance.

There is no need to add ordinary salt to formulated supplementary foods.

6. Guidelines for composition expressed on dry weight basis

	Units per 100 calories*	Units per 100 grams
Protein	5.4g	not less than 20g**
Fat	-	as much as feasible, up to 10g
Crude fiber	-	not more than 5g***
Moisture	-	preferably 5 - 10g
Total ash	-	not more than 5g
Acid-insoluble ash		not more than 0.05g
Vitamin A, retinol equivalent	108mcg	400mcg****

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*Calculated on the basis of 370 calories per 100 grams.

**This protein level assumes an NPU not less than 60 and a PER not less than 2.1. If these values are higher, the level of protein may be reduced accordingly (see Section 1).

*** Crude fiber higher than this may be acceptable although it would require clinical testing.

****1300 International Units as vitamin A palmitate.

	Units per 100 calories	Units per 100 grams
Thiamine	80mcg	0.3mg
Riboflavin	108mcg	0.4mg
Niacin	1330mcg	5.0mg
Folate	54mcg	0.2mg
Vitamin B_{12}	0.54mcg	2.0mcg
Ascorbic acid	5400mcg	20mg
Vitamin D	108IU	400IU
Calcium	80mg	300mg (as phosphate or carbonate)
Iron	2.7mg	10mg (as food-grade compound of adequate iron availability)
Iodine	28mcg	100mcg (as iodate or iodide)

Note:

Under certain local conditions, the addition of vitamin B_6 (to approximately the level of thiamine) and of alpha-tocopherol should be considered.

The values for vitamins and minerals are considered minimal, except in the case of vitamin D, where no further increase is desirable. The excess of each vitamin added during processing should be no greater than that needed to maintain label requirements over the expected shelf-life of the product.

7. Food additives

The use of excessive amounts of flavoring agents should be avoided. If any food additives are used, they should be those which have been cleared by the Joint FAO/WHO Expert Committee on Food Additives. The amounts used should not exceed the minimum necessary to produce the desired effect. Necessary information must be given on the label on the nature and quantities of food additives used in the product.

8. Standards and purity

8.1 The ingredients in the formula should meet national and/ or international standards with regard to purity. The Protein Advisory Group has prescribed quality guidelines for some common ingredients.

8.2 Legumes and oilseeds may frequently contain tryptic inhibitors and other undesirable factors which must be reduced by processing before use in high-protein foods. Since all toxic factors may not be eliminated by processing, it is essential that only grain legumes which are nutritionally wholesome and toxicologically safe be used.

8.3 The preparation of a protein concentrate from oilseeds may require solvent extraction. Adequate procedures requiring food-grade solvents are described in the Joint FAO/WHO Expert Committee Report No. 14. It is necessary to eliminate the dangers of toxicity from solvents by using food-grade products.

8.4 Cereals, oilseeds and other source materials to be used in the basic mixture may be contaminated with toxic molds. The Protein Advisory Group has reviewed this problem and issued a statement (PAG Statement No. 2) on the subject.

9. Microbiological and sanitary standards

Guidelines for microbiological and sanitary requirements are available as PAG Guideline No. 11.

10. Packaging

Packages and the containers in which they are shipped should provide protection from the inroads of insects, microorganisms, moisture and contaminants. If foods are dispensed from bulk containers, proper sanitary procedures should be observed. Simple but effective information with respect to the correct use of the product should be on the package.

11. Shelf-life

The packaged product should remain acceptable for food use in terms of retention of palatability, nutritional availability and freedom from toxic or other deleterious changes for a period of six months under tropical conditions.

Note: This guideline is a revision of one originally published on 11 February 1971.